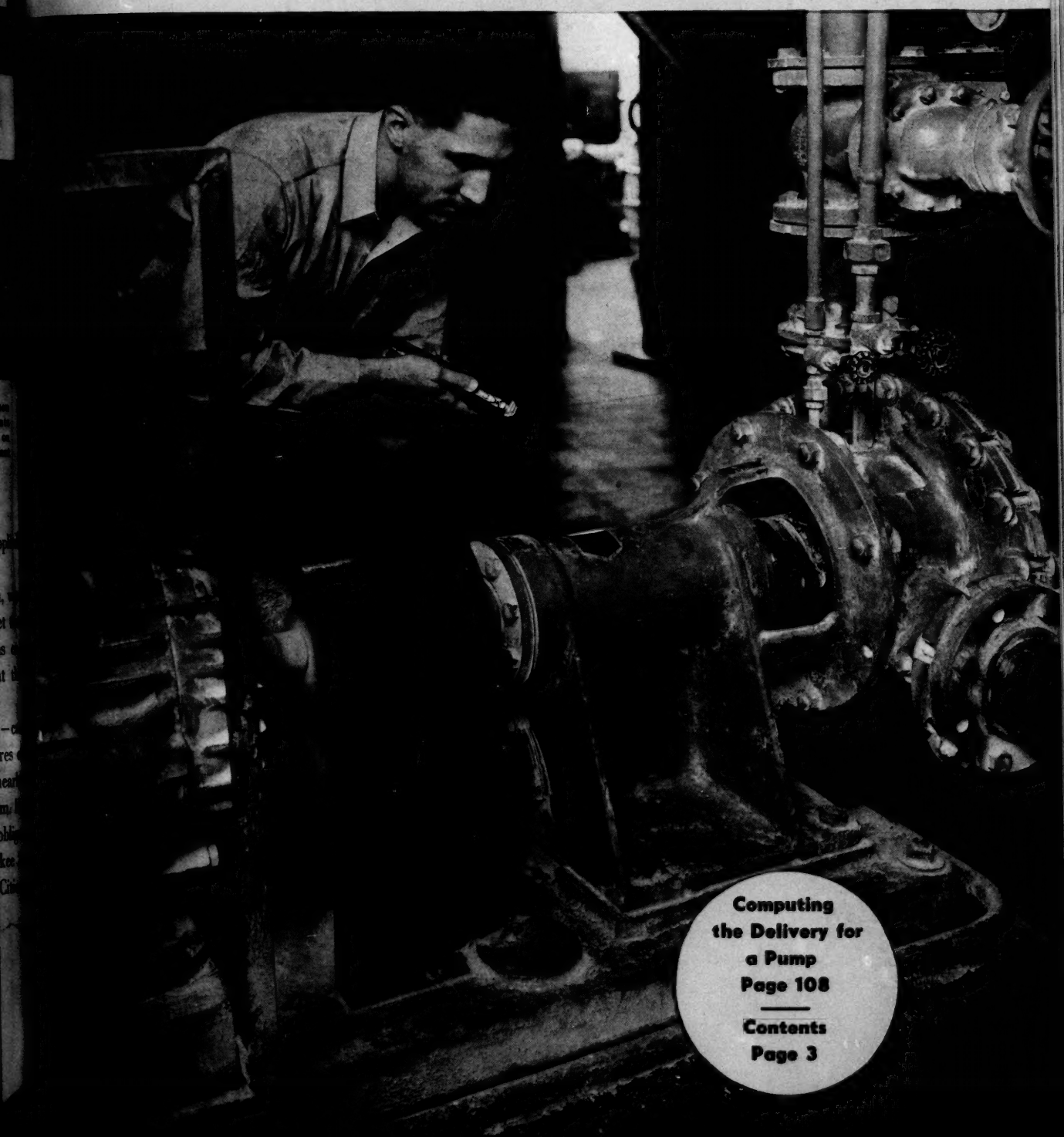
NOVEMBER, 1954—51st YEAR

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING — PIPING — REFRIGERATION — AIR SANITATION



Computing the Delivery for a Pump
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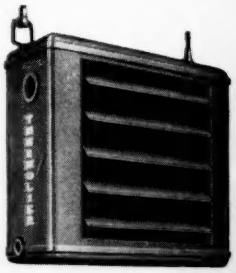
HEAT

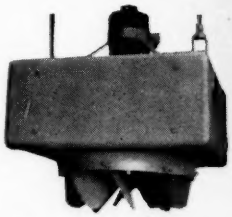
where you want it
when you want it
whatever the fuel you use

GRINNELL UNIT HEATERS

Horizontal Gas-Fired Model for natural, manufactured, mixed and LP Gases.



Horizontal Model for steam and hot water systems.



Vertical Model for steam and hot water systems.

Grinnell quality is well known. The "Grinnell" name is backed by over 60 years of heating experience. Regardless of the type and model you choose, you can depend on a Grinnell Unit Heater to give balanced heating performance plus maximum fuel economy. Call on Grinnell . . . for the unit heater to meet your specific needs.

GRINNELL
Gas-Fired Unit Heater

Available in 7 sizes — ranging from 25,000 to 200,000 Btu per hour input

Grinnell Gas-Fired Unit Heaters are easy to install, simple to operate and maintain. Efficient performance is assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit. Automatic safety pilot operates to shut off main gas supply if pilot goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. American Gas Association approved.

GRINNELL THERMOLIER
Steam/Hot Water Unit Heater

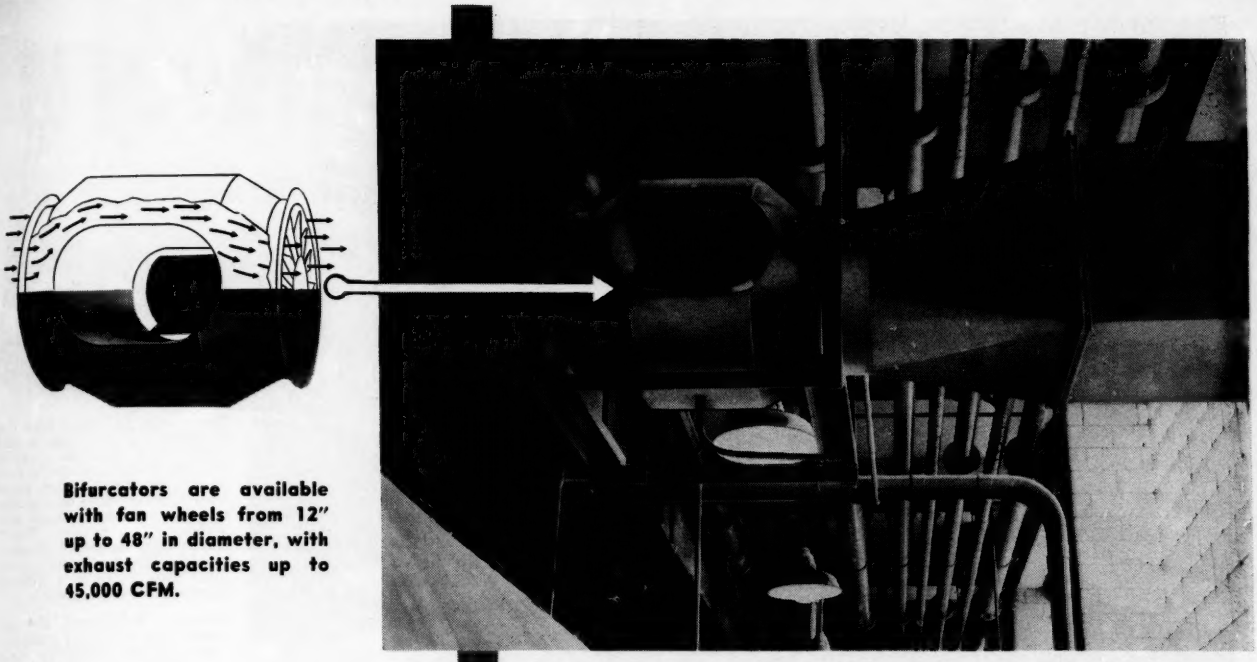
4 models . . . 18 sizes — from 35,600 to 275,300 total heat delivered, Btu per hour

Three basic models—horizontal, vertical and a special horizontal Textile model. (Adjustable velocity nozzle also available for use on horizontal models.) All models have plain thermostatic trap, the simplest and least expensive kind of a trap, made practical because of unit's exclusive internal cooling leg; maximum capacity provided and destructive water hammer eliminated by built-in pitch of tubes. Many other important features.

GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

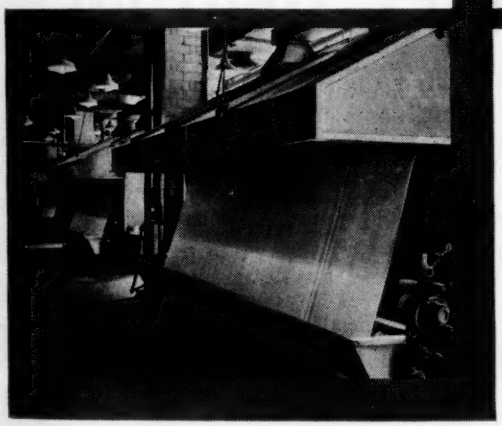


Bifurcators are available with fan wheels from 12" up to 48" in diameter, with exhaust capacities up to 45,000 CFM.

FUME *problem*... SPACE *problem*

BIFURCATOR® FANS SOLVE *BOTH* AT CLINTON FOODS INC.

Sulphur dioxide fumes from the starch filters are exhausted by Bifurcator Fans installed right in the ductwork.



In one manufacturing process at the Clinton, Iowa, plant of Clinton Foods Inc., starch filters give off sulphur dioxide fumes which must be exhausted. Choosing exhaust fans for this application, Clinton Foods' engineers had two major requirements. First, the fan motor must be protected from the fumes. Second, fan units must be very compact to fit into the limited space available.

DeBothezat Bifurcator Fans meet both these requirements ideally. The Bifurcator is a direct motor-driven fan in a divided housing. Its motor is in an isolated chamber around which fumes are by-passed, so that the motor stays cool, clean and accessible. A Bifurcator installs just like a flanged section of ductwork, and is scarcely larger in diameter than the ductwork.

The Clinton Foods plant now has 39 Bifurcators in operation, built of stainless steel to resist corrosion.

If *you* have a similar fume removal problem, Bifurcator Fans may be the economical answer for you, too. Why not send for an illustrated catalog now?

DeBothezat Fans

Division of

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

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DeBothezat Fans Division, Dept. HV-1154
American Machine and Metals, Inc.
East Moline, Illinois

Send me free catalog on Bifurcators for exhausting hot, corrosive, flammable and explosive fumes.

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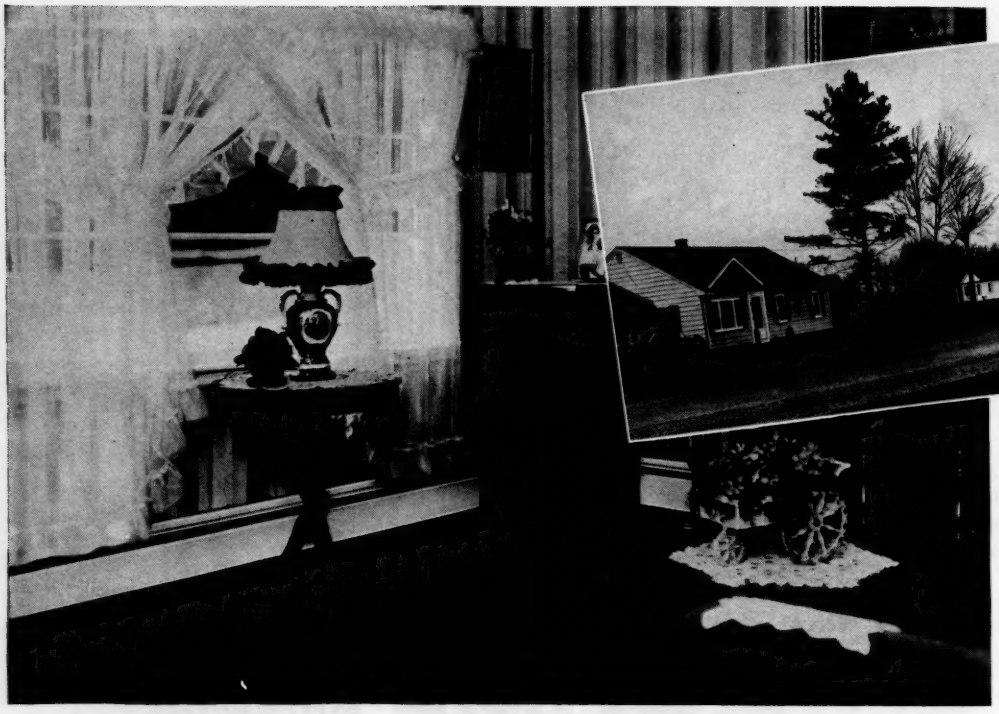

Part of the 147-house project at Cedarcrest, a charming wooded section of Canton, Mass., where gracious living is tailored to modest budgets. Ranch houses, priced from $10,400, have heating comfort of custom-built homes with Webster Tru-Perimeter Forced Hot Water Baseboard Heating. Builder: Frank Losordo Sons, Inc., Hyde Park, Mass. Heating Contractor: Frank Losordo.

Webster Baseboard Heating blends with the living room decoration in this Cedarcrest home . . . blankets large window area and all exposed walls with gentle, clean, uniform heat. Complete freedom in furniture arrangement.

$10,400 Ranch Home with Webster Tru-Perimeter Heating

Frank Losordo Sons, Inc., builds these three-bedroom ranch homes, size 36x24 feet, to sell for $10,400, with Webster Tru-Perimeter Forced Hot Water Baseboard Heating. Says Frank Losordo, "The low cost operation of a good heating system is a big sales factor."

Heating is gentle and draft-free . . . Picture window areas are completely comfortable . . . There's no loss of floor or wall space, no "heating" in sight, nothing to interfere with furniture decoration . . . Wasteful overheating is avoided.

Quality operative builders like Frank Losordo Sons, Inc., have found that Webster Tru-Perimeter Forced Hot Water Baseboard Heating meets their requirements. It is economical to install. There is a minimum of piping, no air ducts, radiators or registers. The heating unit combines the heating element and heating main, and is concealed behind unobtrusive baseboard. Simplified design means fewer parts, less time and money spent on the job.

Send today for 16-page illustrated technical bulletin on Webster Baseboard Heating . . . Ask for Bulletin B-1602.

Address Dept. HV-11

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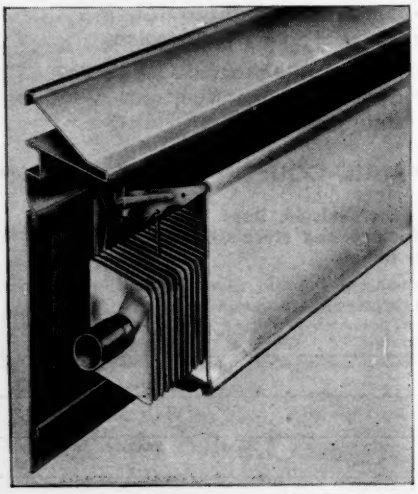

Cut-away view showing Webster Tru-Perimeter Forced Hot Water Baseboard Heating. Note its simplicity.

Webster

TRU-PERIMETER FORCED HOT WATER BASEBOARD HEATING

AND **Webster Walvector®, standard and custom for Tru-Perimeter Heating; Convectors; Radiator Valves, Thermostatic and Float and Thermostatic Traps, Dirt Strainers, Double Service Valves, Boiler Return and Vent Traps, Lift Fittings, Expansion Joints, Hot Water Heating Specialties and Controls; Webster Moderator Controls for Steam Heating, Gas, Steam and Hot Water Unit Heaters. Data on request.**

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, PLUMBING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

NOVEMBER, 1954

VOLUME 51—NO. 11

Photograph, courtesy of Allis Chalmers Manufacturing Company. Checking material delivery of a pump. See page 108.

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Washington News

LORING F. OVERMAN

REGARDLESS of the outcome of the elections, several programs of direct interest to those in heating, ventilating and air-conditioning fields will come up for consideration when the new Congress convenes in January. Among them are the following:

The public housing proposals.
FHA insured loans for home modernizing and improvement.
Proposed federal aid to school construction.
Federal assists for highway construction.
The "Big Change" defense program.

Key Housing Programs

The public housing and FHA home improvement programs will come in for early action, for the home improvement phase is to expire in next June 30 unless Congress renews it. The latter measure is in the dog house at the moment, because of racketeering in this field, with large numbers of homeowners victimized.

As for public housing, President Eisenhower had asked for a four year program calling for 35,000 public housing units annually. Congress authorized only a one year program, but the Administration is expected to renew its request in January. Proponents of private housing are already conducting a nationwide campaign to oppose any such a move, and a lively controversy is in prospect.

School Outlook

Because school construction is customarily of the top-quality, built-to-last variety, H&V readers will be interested in estimates that between $10 billion and $12 billion for that type of construction is necessary in order to keep pace with the increasing need. Here, again, the idea of federally financed aid to education has its proponents and opponents. Both agree as to the extent of the need, as well as to the probable cost. But they disagree as to the part Washington should play in providing the solution to educational problems.

In opening a public hearing before the House Labor Subcommittee on the subject, Representative Kearns (R-Pa), committee chairman, said that the $10 to $12 billion figure was based on a survey among state governors. He said the federal aid to construction, now available in areas where government installations have overtaxed local facilities, has proved so satisfactory "that it has helped greatly to prove that school construction is the answer to any phase of federal assistance to education."

Taking an opposite view at the same hearing, the National Association of Manufacturers explained, "We believe federal financial support of a state-local function is untenable in principle and unsound in practice." NAM asked for "an uniquivocal disavowal on the part of the Federal Government of responsibility and of need or willingness to participate in the provision of public education."

Samuel Brownell, Commissioner of Education said, "No single measure at the federal level is going to solve the school construction problem." He concurred in the estimate that a program costing $10 to $15 billion to construct new schools is needed over a 10-year period.

"Solution of the problem," he said, "is dependent upon continuous large-scale school construction for at least 10 years, including action in individual school districts and states, regardless of what action is taken in Washington."

Highway Program Favored

Hearings on proposals for federal participation to the extent of $50 billion in the next 10 years for highway construction resulted in little opposition. The hearing was conducted by an advisory committee headed by retired General Lucius D. Clay. In opening the hearings, General Clay said that preliminary estimates indicate that highway construction needs during the next 10 years will total about $101 billion. If present allotments for such purposes are continued, he said, about 47 billion dollars would be made available for this purpose, leaving a deficit of about $54 billion.

The highway proposal is of interest to H&V readers principally because of the changes which follow superhighways. Cities move to the suburbs; new air-conditioned theaters and shopping centers spring up—while the older parts of towns either modernize and fight to keep alive . . . or else.

Not awaiting action on hearings and legislation, highway construction made its own record in September, reaching $445 million—a new all-time high for any one month. During the same month, private and public spending for construction of all kinds totaled $3,619 million. This equalled the all-time record set in August, and was 8% above a year ago. The September pickup is sparking estimates that construction expenditures for the year 1954 will total $36.5 billion—a new record which would top earlier government estimates by $500 million.

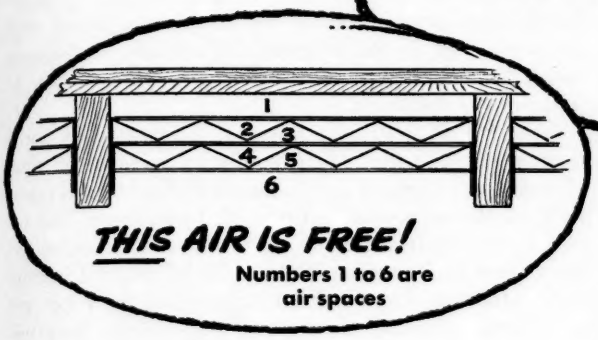
"Big Change" to be Considered

The defense program has toyed with mobilization bases, new looks and several other ideas in recent months. Come January, there are indications that the idea of a Big Change will come in for much discussion. One of the difficulties with past and present versions of defense programs, it would appear, is that American industry just isn't in the habit of running half speed. Given an all-out war to produce for, American industry spits on its hands and moves right in. When the assignment is to be prepared, but without producing too fast, the production machine develops gremlins.

What has all this to do with the heating, ventilating, piping and air conditioning industries? Much, if a sudden emergency should require action. Then, as in all past emergencies, there would be a mad scramble to qualify for defense production, or to secure allocations of materials and manpower for civilian production.

For example, under the Production Allocation Plan

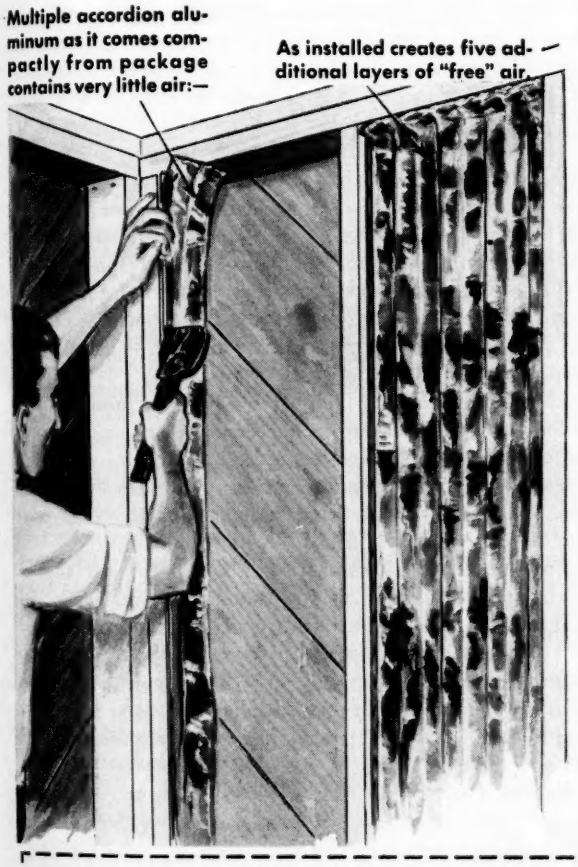
WHO SAID AIR IS FREE?



Were it not for Radiation and Convection, empty air spaces inside walls, roofs, etc. would be the best insulation. But why pay costly labor and storage bills for handling "free" air entrapped **before** it is used in bulky insulation? Bulky materials also require more freight cars, trailers and trucks. The "free" air is paid for over and over again.

Multiple accordion aluminum envelops large volumes of air and creates layers of air spaces **only** as it is opened when finally stapled in place. This air is **really** free.

With respect to radiant heat flow, the aluminum sheets have 97% reflectivity, and 3% absorptivity and emissivity. Low conduction results from the preponderant air spaces of low density. The layers of multiple aluminum and fiber retard inner and outer convection. The tough aluminum sheets are almost impervious to vapor. Infiltration under flat stapled flanges is slight. Condensation formation on or within is minimized by the scientific construction.


Multiple accordion aluminum as it comes compactly from package contains very little air:—
As installed creates five additional layers of "free" air.

MILLION SQ. FT. IN ROOM 12' x 13' x 13'

Because of the low mass of unopened, practically airless multiple accordion aluminum, an ordinary passenger automobile will hold 20,000 sq. ft. of it without being or even looking overloaded. A standard railroad freight car, a huge interstate trailer, or a number of trucks would be needed to transport an equivalent amount of ordinary insulation.

To obtain MAXIMUM, **uniform-depth** protection against heat loss and condensation formation, it is necessary to use the new **edge-to-edge** multiple aluminum*, **each** sheet of which stretches from joist to joist, and also all through the flanges for further vapor protection as well as permanent attachment of each sheet.

The AMERICAN SOCIETY OF HEATING VENTILATING ENGINEERS has published a booklet which describes convection, conduction, and radiation heat flow through *ordinary* air spaces and what happens when an ordinary building space is lined or subdivided by reflective metals, thus creating reflective air spaces. Ask us for a copy—it's free.

*Patent applied for.

COST OF EDGE-TO-EDGE INFRA
Multiple Aluminum Insulation
installed in new construction between wood joists, material and labor
Type 6-S under 9½¢ sq. ft.
Type 4-S under 7½¢ sq. ft.

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which was in effect prior to the Korean war, some 34,000 companies were committed to specified types of defense or civilian production in the event of hostilities. When the Reds crossed the 38th parallel, the Production Allocations idea was not too successful. This was principally because the plan covered just about every civilian item, as well as those needed for defense.

In the hope of avoiding such disappointments again, the Department of Defense, about a year ago set up new yardsticks to measure defense materials to be included in allocations programs. It also proposed a preferential planning list of about 1000 important end-items for which allocations would be made. This list-of-1000 has never been announced, but it is believed nearing completion. At the moment the Department of Defense considers it "restricted", but industry as insisting that it be shown the list as a guide to what will be expected.

Meanwhile, any H&V reader whose company was registered as a potential producer under the original list of 34,000 should check with the Department of Defense to determine whether the item signed up for is still needed; whether there are new items which the plant could produce. This information may be secured by checking Production Allocation plan books at purchasing offices for Ordnance districts, Navy Procurement offices, or Air Force procurement centers. A company on the list should check to see whether purchasing offices have the information. Those not on the list may wish to take steps to become listed.

Multiple Sources Studied

Getting on the production list, even though some competitor has the inside track, may be considerably simpler under the big change defense plans. The Department of Defense is now about ready to concede that multiple sources of supply for defense materials have certain advantages—even though economy may not be one of them. The DOD is now taking into consideration the possibility that a single H-bomb has the power to wipe up a entire source of supply, if that source be a single plant. So thought is being given again to the idea of lining up one or more alternate suppliers of everything the defense program is likely to need.

Another idea to be reconsidered—although it has not proved practicable in the past with economy alone as the yardstick—is the production pool made up of a group of smaller suppliers. Idea of these pools is that such companies, working together, could produce and assemble the various parts of a given item, even though no one company in the group could do the entire job.

Washington Miscellany

Fuel Testing Lab. A double-duty heating and ventilating system to provide quick changes of air is one of 12 special safety features of a new fuel testing laboratory under construction for the Air Force at Wright Air Development center, Dayton, Ohio. Purpose is to provide greater safety and efficiency in testing aviation fuels. Among other safety features: foam fire extinguisher system, scored windows to let glass buckle out in case of explosion; light concrete slab roof that will blow off and reduce extensive wall damage.

Small Business Loans. Loans to small business were approved at the rate of 858 during the first year's operation of the Small Business Administration. Total amount involved was $47,323,000. The program began October 1, 1953, upon termination of the business lending program of the Reconstruction Finance Corporation. Almost 70% of the loans, for a total of $33.8 million, were made with private banks participating. The remainder, 270 loans for a total of $13.4 million, were direct SBA loans.

SBA Administrator Wendell B. Barnes expressed gratification that private lending institutions are taking such an active part in the program. In addition to business loans, the SBA approved 348 business loans during its first year of operation.

Scientists' Mobilization Planned. A special task force to study the best method of mobilizing scientists in time of war is to be headed by Dr. James R. Killian, Jr., president of Massachusetts Institute of Technology. The report is to require three or more months, according to Dr. Arthur S. Flemming, Defense Mobilization Director.

Fee Appraisers to Aid FHA. Liberalized FHA loan requirements, resulting in stepped-up building, have encountered an unexpected bottleneck in the appraisal department. FHA is too short of staff appraisers to give prompt service on loan applications, so fee appraisers are to be employed until the log jam is broken. The fee appraisers are to be engaged at the local level, and only if there is at least a 15-day backlog of loan applications.

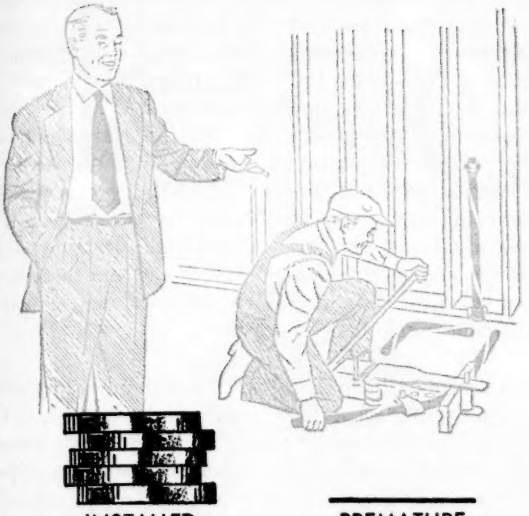
Oil and Gas Men Named. Interior Secretary Douglas McKay has named High A. Stewart and Carroll D. Fentress as director, and assistant director, respectively, of the Oil and Gas Division of the Department. Mr. Stewart has been acting director since Interior Oil and Gas Division was reorganized upon termination of the Petroleum Administration for Defense. Mr. Stewart came to the PAD from the Texas Company, and Mr. Fentress from Standard Oil of Indiana.

Metals Identification Important. Industry and the Department of Defense are in agreement on the need for a uniform metals identification system. There are some differences of opinion as to how much of a system is needed; what the effect of a marking system would have on production cost, and how best to do the job.

Proponents of a uniform standard point out that a recent accident to the Atomic submarine Nautilus could have been avoided if an effective system of marking had been followed. It seems that the seamless tubing was adequately inspected at the mill, so it is assumed that at the shipyard it was mingled with supplies of welded pipe, and then installed unwittingly at points where seamless tubing was specified.

Metallic Plastic Pipe Patch. The Navy recently adopted a new plastic patch that has partially solved the problem of emergency repair of ruptured or damaged piping aboard ship. The plastic patch, which has all the simplicity of a firstaid bandage for a wounded man, is easily applied and can, for instance, put a ruptured fire main system, magazine sprinkling, or salt water cooling system back into operation in approximately 30 minutes. Tests so far indicate that metallic plastic pipe patches should be used only on salt or fresh water piping where pressure does not exceed 300 pounds, or temperature is not above 200 F. However, other tests are now being conducted to find methods of applying this plastic patch to lines carrying steam, gasoline, or other material.

WHICH WILL IT BE . . .



INSTALLED COSTS

PREMATURE REPAIRS

INSTALLED COSTS

PREMATURE REPAIRS

a little more NOW—or a lot more LATER?

Let's take a close look at this so-called higher cost of wrought iron pipe.

All too often, INITIAL COSTS are used as the only basis of comparison. The fallacy of the initial-cost-yardstick has been proved time and time again in installations where low-first-cost piping has been installed and has failed prematurely. The original installation was quickly made by pipe fitters. But repairs call for hours of work by as many as five craftsmen—pipe fitters, masons, carpenters, plasterers, painters. And labor costs are only part of the picture. The indirect costs of production slowdowns and disrupted routine swell the total of every premature pipe failure. It's easy to see how this first failure can wipe out initial "savings" many times over.

The only *valid comparison* of piping costs is INSTALLED COSTS *plus* REPAIRS. This yardstick places the emphasis where it rightly belongs . . . on SERVICE LIFE. In installation after installation, wrought iron pipe has doubled, tripled and even quadrupled the useful service life previously obtained from low-first-cost piping. All this adds up to one thing . . . the fact that you pay a little more for wrought iron means that you pay a LOT LESS FOR MAINTENANCE. Wrought iron gives you *piping economy,* because it lasts longer, at lower cost per year!

If you are concerned about piping services where corrosion is a threat to durability, you'll find it profitable to investigate the longer life of wrought iron pipe. Our Engineering Service Department will be happy to send you examples of typical wrought iron service records in installations similar to those in which you are interested. Write or call.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Department: New York, N.Y.

Why Genuine Wrought Iron Lasts

This notch-fracture test specimen illustrates the unique fibrous structure of wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glasslike silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

BRIEFLY STATED

• An array of catalytic devices to eliminate contaminants in automobile exhausts as well as in industry and in the home was displayed recently before the Franklin Institute in Philadelphia. The demonstration included the first public presentation by Oxy-Catalyst, Inc., of three new catalyst-equipped products; an automobile muffler, a home gas incinerator, and a room air purifier. The catalytic muffler, similar in size, shape and location to a standard acoustical muffler, burns engine exhaust hydrocarbons and carbon monoxide to a harmless effluent of water vapor and carbon dioxide. The incinerator has a small catalyst chamber to oxydize exhaust fumes. The room air purifier is an adaption of an ordinary air circulating fan with a flat wire coil catalyst installed at the intake end.

• Food Machinery and Chemical Corp. has announced its purchase of Chicago Pump Co., a producer of patented sewage treatment and disposal equipment and specialty pumps for building services. As a subsidiary of FMC, Chicago Pump Company will be an operational component of the parent corporation's Peerless Pump Division. According to G. F. Twist, FMC vice-president and manager of Peerless, the newly acquired subsidiary will continue to operate under the direct management of George D. Bers, president of Chicago Pump, and Milton Spiegel, vice-president and general manager.

• David E. Feinberg, formerly vice-president, has been elected president of United States Air Conditioning Corp. Mr. Feinberg, a graduate of the University of Minnesota with a degree of Mechanical Engineer, has been an officer and director of the corporation for several years.

• The board of directors of Bituminous Coal Research, Inc., has announced the appointment of James R. Garvey to the position of assistant director of research, in charge of the Columbus branch office and laboratory. He will also serve as general manager of BCR Products, Inc. Mr. Garvey succeeds Elmer R. Kaiser who has accepted the position of director of research for ASHVE. Mr. Garvey came to BCR in 1946 as development engineer on design and development of residential heating equipment. In 1948 he joined Mr. Kaiser in establishing a BCR Columbus branch and assisted him in the operation and planning of the BCR-Columbus activities. He has been responsible for building operation and maintenance and supervision of laboratory research projects.

• Thomas P. Brown, Jr., assistant chief system operator of the Consolidated Edison Co. of New York, Inc., and recently elected first vice president of the National District Heating Association, died recently at the age of 46. Mr. Brown spent three years in the engineering department of the B. F. Goodrich Company in Akron, after which he joined the New York Steam Corporation as report writer in the production department. He rose through various positions in this company to become assistant to the manager of the department. Several years ago he was transferred to the parent company, Consolidated Edison, and named to the system operating position which he held at his death.

• Mr. George W. Brown, executive engineer of Wagner Electric Corporation, was elected a vice-president by the company's board of directors on July 28. In his new capacity Mr. Brown will have complete charge of Wagner's Engineering and Research Divisions, both automotive and electrical, and will also serve as a member of the company's executive committee. Mr. Brown, a graduate of Ohio State University, joined the Wagner company in 1926, and for ten years worked in the electrical engineering department. In 1937 he was appointed to the position of personnel director. In 1945, he became industrial relations director. In 1952 he returned to engineering as the company's executive engineer, with responsibility for the general executive direction of automotive and electrical engineering and the metallurgical and chemical departments. He will continue this work on a broader scale as vice-president.

• A new all-jet component air conditioning unit with no compressor is being field tested by the Ultrasonic Corp. The jet air conditioner uses heat as an energy source to drive refrigerants through a system containing a jet pump, ejectors and other components. The company states that jet power can be used to heat as well, when needed.

• Edgar A. Burt has been appointed chief engineer of Orr & Sembower, Inc., Reading, Pa. Mr. Burt previously was with Westinghouse Electric Corp., Philadelphia, where he had been manager of one of the development engineering sections of that company. He attended Drexel Institute of Technology and the Franklin Institute of Philadelphia. Mr. Burt served overseas with the U. S. Army Corps of Engineers during World War II at the Port of Shanghai in the China-Burma-India Theatre.

• One of the most extensive modernization programs yet undertaken in an existing office building will be started immediately in the seventy-seven story Chrysler Building at 42nd Street and Lexington Avenue, New York City, it was announced by Webb & Knapp, Inc., principal owners of the building. The alterations will bring full air conditioning facilities of the latest type to the skyscraper. Installation of this new feature, at a reported cost of several millions dollars, has already started and is scheduled for completion in twelve months' time.

• R. A. Locke was re-elected president of the Steel Boiler Institute and E. I. Boardman, manager, Spencer Heater, Lycoming-Spencer Division, Avco Manufacturing Corp., was elected vice president. Mr. Locke is also secretary and treasurer. John T. Dillon, president, The Titusville Iron Works Co., Division of Struthers Wells Corp., Titusville, Pa., was elected a member of the Board of Directors.

• At the annual meeting of National Association of Fan Manufacturers, Inc., the following officers were elected for the ensuing year: R. W. Nelson, president; C. C. Cheyney, vice president; J. M. Birkenstock, honorary vice president; and G. W. McCormick, Jr., secretary-treasurer. Mr. Nelson is a vice president of American Air Filter Co., Inc. Mr. Cheyney is a vice president of Buffalo Forge Co., and Mr. Birkenstock is the general manager of The Green Fuel Economizer Co., Inc.

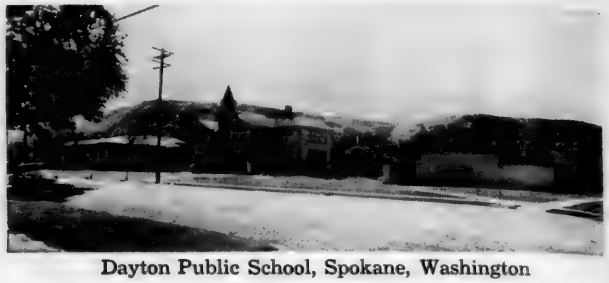
design LEADERSHIP

If the ever expanding reputation of DELANY FLUSH VALVES is based on any single outstanding feature, that deserving component is the chromed leather diaphragm, shown above complete with monel bypass port. COYNE & DELANY is relatively unique in the designation of leather for diaphragm use although leather has been found to be remarkable as to life span where endurance is all important. Leather was further selected because it is resilient, yet nonelastic, and hence the danger of squealing, hammering close off is eliminated in favor of the smooth slow closing action that is the hallmark of DELANY VALVES. True protection is provided for the minute bypass hole by the use of monel. Corrosion is thus precluded, and a fine mesh monel screen on the inlet side (not shown) safeguards against clogging in sandy or brackish water. For more detailed flush valve and vacuum breaker data contained in Handbook and Catalog 53, write Engineering Department, COYNE & DELANY CO., 834 KENT AVE., BROOKLYN 5, N. Y.

DELANY-*the fastest growing name in flush valves!*

From Holyoke, Massachusetts to Spokane, Washington . . .

John J. Lynch Junior High School, Holyoke, Mass.



Dayton Public School, Spokane, Washington

. . . from Albuquerque, New Mexico to Portsmouth, Virginia . . .

Montezuma Elementary School, Albuquerque, New Mexico

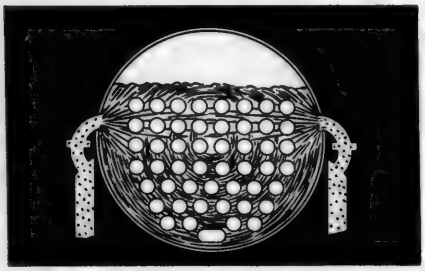
Cradock High School, Portsmouth, Virginia

Schools across the nation choose Pacific Boilers with *Jet-action* Circulation!

In schools across the nation, the swing is to Pacific Boilers. The reason: Pacific's exclusive *Jet-action* Circulation, with its efficient heat transfer and economical operation.

For example, the modern schools shown above are located in cities that practically run the gamut of climatic conditions to be found in the U.S.—in such widely separated cities as: Holyoke, Massachusetts; Spokane, Washington; Albuquerque, New Mexico; and Portsmouth, Va.

In each case, the architecture is modern and functional—designed for the greatest comfort and convenience of pupils and faculty. In each case, Pacific Boilers were chosen to do the heating job.



Exclusive *Jet-action* Circulation

You see this, more and more. Fact is, Pacific Boilers with *Jet-action* Circulation are fast becoming *standard equipment* in schools.

For *Jet-action* Circulation, Pacific's outstanding advance in boiler engineering, cuts fuel costs—permits nearly instant response when a change in temperature is desired. The secret? Pacific's exclusive jet connections, which project a high-speed stream of steam and water across the heating tubes. This turbulent "washing" action sweeps tubes clean of clinging, heat-insulating bubbles. Tubes absorb heat faster; fuel consumption is lowered.

You can pass these benefits along to *your* customers: simply specify Pacific Boilers with *Jet-action* Circulation. They're quickly and easily installed. And they come in all sizes, using all fuels, for all types of buildings.

For engineering data, catalogs and other information, give your local Pacific representative a call—today!

Designed Constructed and Stamped in Accordance with ASME Code

UNITED STATES RADIATOR CORPORATION: Boilers, Radiators, Heating Accessories • Pacific Boilers • Cyclotherm Steam Generators • Metal Products • Drayer-Hanson Air Conditioning and Commercial Refrigeration

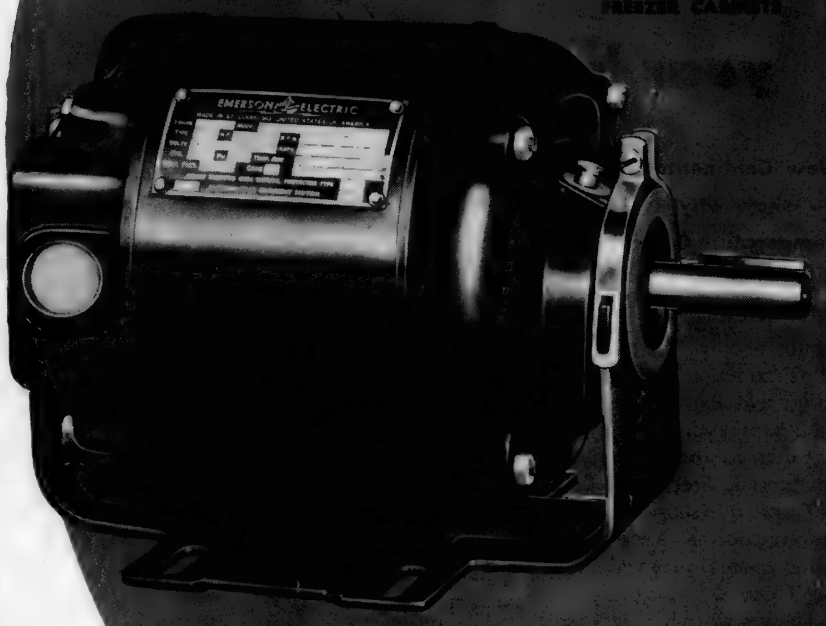
Pacific Steel Boiler

DIVISION OF UNITED STATES RADIATOR CORPORATION

GENERAL OFFICES DETROIT 31, MICHIGAN

AIR CONDITIONERS
FANS OIL BURNERS WASHING MACHINES
IRONING MACHINES FURNACE BLOWERS
EVAPORATIVE COOLERS OFFICES MACHINES PHONOGRAPHS
VENDING MACHINES HOME WORKSHOP TOOLS PUMPS
STOKERS UNIT HEATERS REFRIGERATORS
FREEZER CABINETS

AT THE VERY HEART OF FINE REPUTATIONS.. AN EMERSON ELECTRIC MOTOR



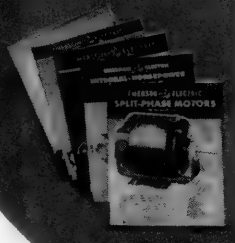
The valuable extra you get with your Emerson-Electric motor

You probably know that the Emerson-Electric motor has helped to build more than one product reputation by its outstanding performance.

But are you aware that you can take advantage of the specialized experience and technical skill of Emerson-Electric Engineers and Designers on anything related to electric motors?

Often, a simple change in design or production technique can save you many dollars, deliver better performance for you. Remember, Emerson-Electric has specialists ready to help solve your most complex motor problems.

THE EMERSON ELECTRIC MANUFACTURING CO.
St. Louis 21, Mo.



Write for information on this consulting service, or bulletins on Emerson-Electric's complete line of NEMA standard motors from 1/20 to 5 h. p. (Check Bulletin desired.)

- ☐ M457-A Capacitor-Start
- ☐ M457-B Split-Phase
- ☐ M457-C Integral
- ☐ M457-D Fan Duty
- ☐ M457-E Oil-Burner
- ☐ M457-F Jet Pump
- ☐ M457-G Blower

EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

How Honeywell Customized Temperature Control can help satisfy your clients

Provide ideal working weather the year 'round

New Continental Paper Company offices show why Honeywell Customized Temperature Control is becoming a "must" in all types of buildings.

THE people who work in the brand-new Continental Paper Company offices in Ridgefield Park, New Jersey, enjoy some of the "happiest" working weather in America – thanks to the indoor climate planning of Architect L. Freeland Fellgraff.

To provide sensitive, reliable control of the heating-cooling system, Architect Fellgraff called upon Honeywell Customized Temperature Control.

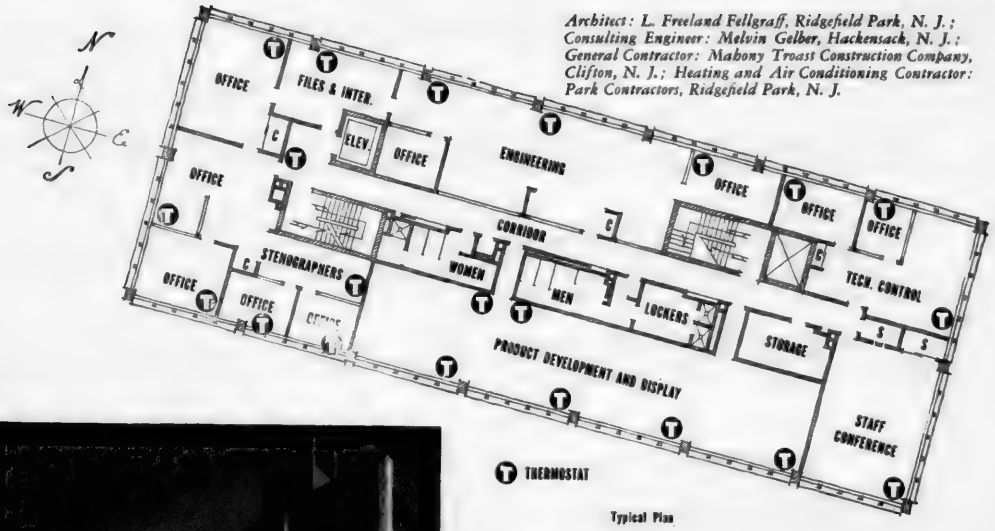
The key word here is "customized." It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants* is your answer.

With a Honeywell Customized Temperature Control installation such as the one in Continental's new offices, you have *enough* thermostats strategically located to compensate for all exposure, use and occupancy problems. Comfort is assured because the control system is "customized" to the design of the building.

Just as we did for the Continental Paper Company, we can do the job for you and your clients. And only Honeywell can give you *complete* customized service. Because, besides our engineering skill, only Honeywell manufactures *all three* types of control—pneumatic, electric, and electronic.

The comfort problems posed by modern buildings are dramatically illustrated by the first floor lobby. Large glass areas heighten the exposure factor, radiate heat in, in summer, heat out in winter. Visitors bring in the outside weather with them. Both these factors, exposure and use, are easily compensated for by the individual Honeywell thermostat in the lobby—and comfort is assured twelve months a year.

Architect: L. Freeland Fellgraff, Ridgefield Park, N. J.; Consulting Engineer: Melvin Gelber, Hackensack, N. J.; General Contractor: Mahony Troast Construction Company, Clifton, N. J.; Heating and Air Conditioning Contractor: Park Contractors, Ridgefield Park, N. J.



Typical Plan

3rd FLOOR PLAN

Another comfort problem arises from the generous use of glass on all four sides of the building. If a cold north wind is blowing, yet the sun is shining warmly through the south windows, the comfort system could get out of balance—if it weren't for Honeywell Customized Temperature Control. Individual thermostats permit control of comfort in individual areas, according to area needs.

A separate thermostat in the staff conference room provides the individual control needed to keep the room comfortable under varying conditions. When a conference is small, more heat (or less cooling) is needed for comfort. For a large conference, less heat (or more cooling). Honeywell Customized Temperature Control takes this into account, keeps the conference room comfortable at all times in any kind of weather.

For comfortable, even temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's a factory, motel, hospital—any building of any size—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems. You can give your clients more comfort and efficiency, and they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. Or mail the coupon today.

William J. Alford III, executive vice-president, Continental Paper Co., says:

"Perfect indoor working conditions were a major requirement of our general administrative quarters. We are pleased with the excellent combination of appearance, comfort and functional efficiency. To help achieve this we turned to Honeywell Customized Temperature Control."

MINNEAPOLIS
Honeywell

First in Controls

112 OFFICES ACROSS THE NATION

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HV-11-213. Minneapolis 8, Minnesota

Gentlemen:

I'm interested in learning more about Honeywell Customized Temperature Control.

Name _____

Firm Name _____

Address _____

City _____ *Zone* ____ *State* _____

General Electric trained experts help Washington builder "custom-fit" air conditioning to needs of each floor

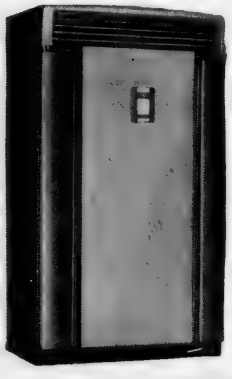
NEW 14-STORY OFFICE BUILDING at 1413 K Street, NW, Washington, D.C. A 15-ton G-E packaged air conditioner on the first floor, 7½-ton G-E units on the next three floors, and one 10-ton G-E conditioner on each of the top 10 floors provide dependable air conditioning throughout the entire building. Designer-builder: J. B. Shapiro. Contractors: Shapiro Engineering Corporation. Consulting Engineers: General Engineering Associates.

Floor area alone is just the beginning when it comes to criteria for determining the amount of air conditioning to provide, and the best location for supply units. That's why J. B. Shapiro, Washington designer-builder, asked his local G-E air conditioning contractor to help him plan the "weather" for Washington's first 14-story office building. G-E trained experts took into consideration all the detailed factors that account for heat gains and losses—even exposure to sunlight, elevator traffic, and nature of tenants' businesses—before making recommendations that resulted in effective, low-cost air conditioning for each floor.

ASK FOR G-E CLIMATE SURVEY

At no cost to you or your clients, your G-E dealer will make a thorough analysis of the air conditioning needs of existing buildings, or work with you from blueprints to air condition new structures.

LOOK AT ALL THE ADVANTAGES OF USING G-E PACKAGED AIR CONDITIONERS



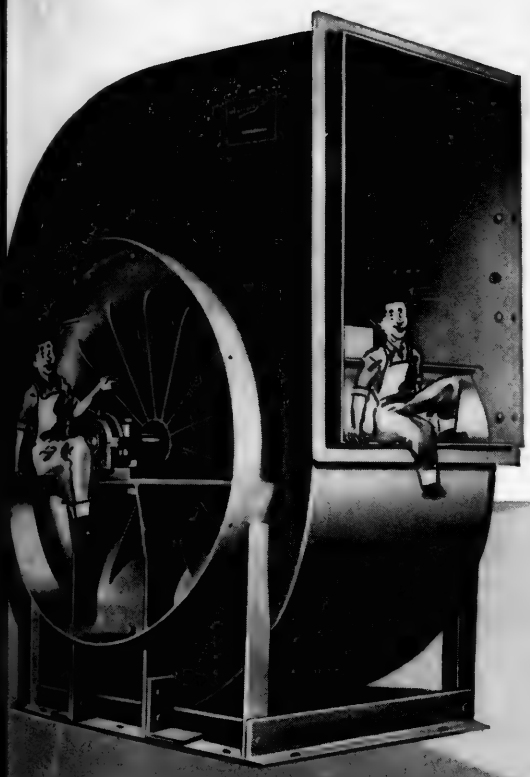
- Low in installation and operating costs.
- 3, 5, 7½, 10 and 15 ton units in single or multiple for any size building.
- Maximum design freedom—use in space or concealed, with or without ducts.
- Streamlined styling blends with any decor.
- Easily directed air flow for no-draft, no-waste air circulation.
- Muggy Weather Control removes excess moisture without overchilling.
- G-E factory assembled. 5-year warranty covers entire sealed cooling system.

Write for complete architectural data.
General Electric Company
Commercial & Industrial Air Conditioning Dept., Bloomfield, N. J.

Packaged AIR CONDITIONERS

Progress Is Our Most Important Product

GENERAL ELECTRIC



FROM INLET TO OUTLET HERE'S MORE AIR PER DOLLAR

. . . WHEN YOU SPECIFY "BUFFALO" TYPE BL FANS

Even before incoming air reaches the wheel of the "Buffalo" BL Fan, it is guided in the most efficient path. The inlet bell is smoothly curved for absolute minimum friction; while the welded-on stationary inlet vanes reduce turbulance and assure rated air delivery even if inlet conditions are unfavorable. The "Buffalo" inlet is one reason why "Buffalo" air-moving costs are low.

The new improved "Buffalo" rotor, too, vitally affects performance. Here the full-curvature die-formed shroud and the backward curved blades move the air through the specially shaped housing and outlet with smoothness, quietness and efficiency. In addition, the fan's performance is stable from shut-off to free air delivery.

Besides these and other features, there is an intangible in all "Buffalo" fans that has always made for high satisfaction. We call it the "Q" factor, or built-in quality which provides long life and freedom from trouble. This is the sum total of the 77 years of "Buffalo" experience and know-how that goes into every fan to leave our plant.

"Buffalo"

For further details on "Buffalo" Type BL Fans, write for new Engineering Bulletin F-100

BUFFALO FORGE COMPANY

480 Broadway Buffalo, N. Y.

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

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VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Some of Minnesota's Best Modern Schools

Equipped with POWERS

Modern Systems of Pneumatic Temperature Control

Room Thermostats
are truly gradual acting and give many years of smooth, dependable control of valves and dampers.

Powers PACKLESS Control Valves
eliminate packing maintenance and stop leakage of steam or hot water. Minimum of valve stem friction gives smooth, reliable control.

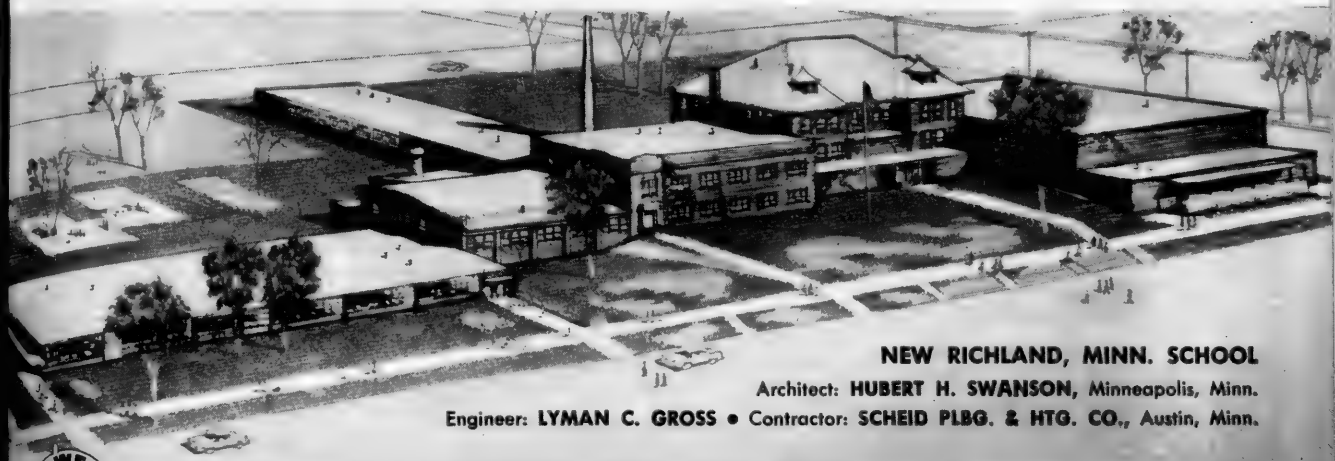
MINNESOTA LAKE, MINN. ELEMENTARY SCHOOL
Architects and Engineers: **HAARSTICK LUNDGREN & ASSOCIATES**, St. Paul, Minn.
Heating Contractor: **EGAN & SONS CO.**, Minneapolis, Minn.

POWERS CONTROL

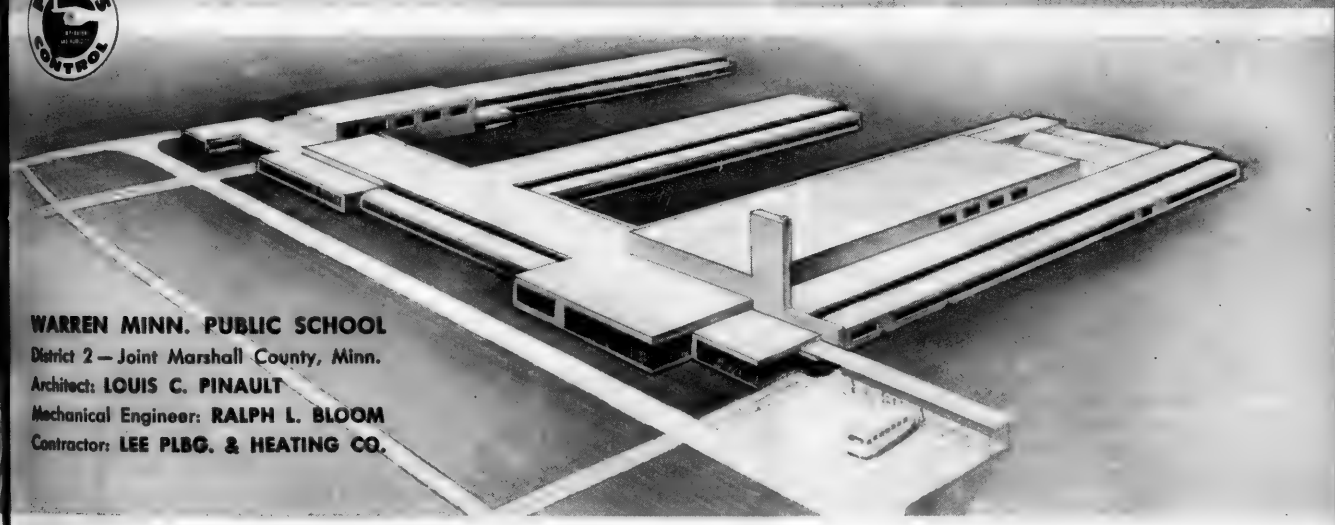
MAUDE ARMITAGE ELEMENTARY SCHOOL
MINNEAPOLIS, MINN.
Architects and Engineers: **MAGNEY, TUSLER and SETTER and PERKINS & WILL**
Contractor: **H. R. NICHOLS PLBG & HTG. CO.**

MONTICELLO, MINNESOTA HIGH SCHOOL
Architects and Engineers: **HAARSTICK LUNDGREN & ASSOCIATES**, St. Paul, Minn.
Contractor: **ANTON YAGER PLBG. & HEATING CO.** St. Cloud, Minn.

Architects: **THORSHOV & CERNY, Inc.,** Minneapolis, Minn.
Engineer: **R. D. THOMAS & ASSOCIATES, Inc.**
Heating Contractor: **EGAN & SONS CO.**



NEW RICHLAND, MINN. SCHOOL
Architect: **HUBERT H. SWANSON,** Minneapolis, Minn.
Engineer: **LYMAN C. GROSS** • Contractor: **SCHEID PLBG. & HTG. CO.,** Austin, Minn.



WARREN MINN. PUBLIC SCHOOL
District 2 — Joint Marshall County, Minn.
Architect: **LOUIS C. PINAULT**
Mechanical Engineer: **RALPH L. BLOOM**
Contractor: **LEE PLBG. & HEATING CO.**

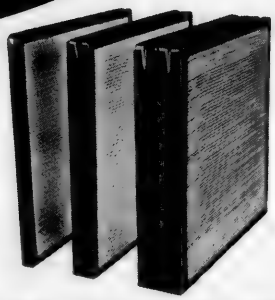
(b78)

POWERS CONTROL ASSURES UTMOST CLASSROOM COMFORT . . . MAXIMUM FUEL ECONOMY

Many users of Powers control report 25 to 40 years of reliable, low maintenance cost service. To insure the best performance from a temperature control system in new or existing school buildings consider the superior features of Powers **PACKLESS** Valves and the greater simplicity of Powers new **LIMITEM** low limit control for Unit Ventilators. Our nearest office will gladly supply complete information about their important advantages.

THE MEASURE OF A GOOD AIR FILTER

1", 2" or 4" thick?



Whether you need filters for package air conditioners or furnaces, for general filtration or for special applications requiring the highest efficiency and greatest dirt capacity, Farr Company has a standard type to fit the job — available in steel, aluminum, copper, stainless and monel.

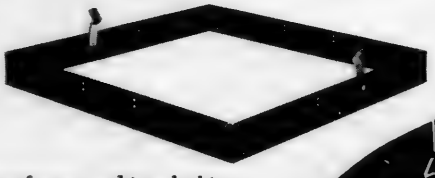
How much media?

In FAR-AIR® filters you get more media per square inch *plus* the famous herringbone-crimp design that assures greater dirt holding capacity and lower pressure loss. Firmly packed media provides even density and assures uniform high efficiency over the entire filter area.

FARR COMPANY
NO COMPROMISE ON QUALITY
Los Angeles, New York, Chicago, Memphis
ORIGINATORS OF FAR-AIR CERTIFIED FILTER SERVICE
MANUFACTURED UNDER LICENSE BY FARR COMPANY MANUFACTURING LTD., MONTREAL, CANADA

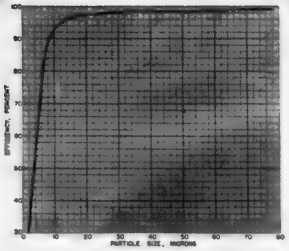
*Trade Mark

What kind of construction?



Heavy gauge filter frames and interlocking holding frames assure rigid filter banks and proper fit. Reinforcing rods drilled through the filter media make the filter more rugged. *Engineered* quality assures longer service life.

How efficient?



High efficiency in a filter is its only real reason for existence. FAR-AIR® filters consistently deliver superior performance. Send for your set of efficiency curves which show how the various types of FAR-AIR® filters will perform for you.

FARR COMPANY
P. O. Box 45187, Airport Station
Los Angeles 45, California

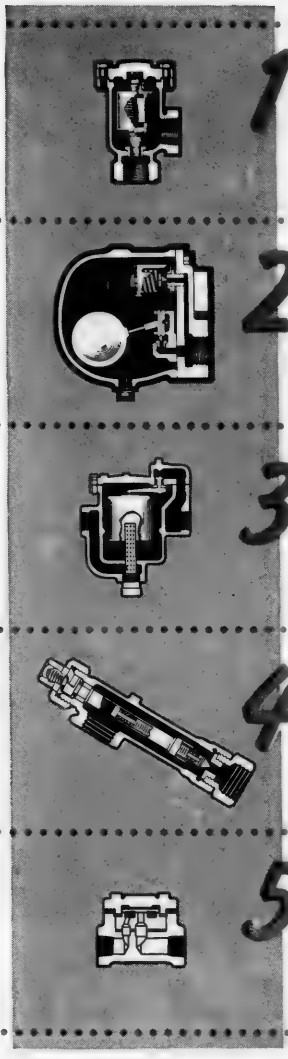
☐ Send efficiency curves
☐ Send a Farr Field Engineer

Name_____ Title_____

Company_____

Address_____

Which type of steam trap is best for your need?



1 Sarco Balanced Pressure Thermostatic
Greatest capacity per dollar cost. Large air venting capacity. Same head and seat, 0-300 psi. Freeze-proof. Cat. 250-A

2 Sarco Float-Thermostatic
Discharges condensate continuously at steam temperature and without shock. Responds immediately to varying loads and pressures. Cat. 450-A

3 Sarco Camlift Bucket
New, powerful Camlift valve mechanism permits greater discharge with no increase in size of trap body. Cat. 360-A

4 Sarco Liquid Expansion
Adjustable to discharge condensate below 212°F. Freeze-proof. Not affected by water-hammer or pressure pulsations. Cat. 260-A

5 Sarco Thermodynamic
Valve head, a solid stn. st. disc, is only moving part. Same head and seat to 600 psi. Not affected by superheat, water-hammer, corrosive condensate. Cat. 255-A

With these 5 different types to offer, Sarco can give you impartial advice

Any type of steam trap will do "some kind" of a steam trapping job for you.

But there's a world of difference in trapping efficiency when exactly the *right* type of trap is used for a given application.

That's because both trapping conditions and the characteristics of different types of traps vary widely. There simply isn't any *one* type of trap that will do an efficient job under *all* circumstances. But there is always a particular type of trap best suited for each *specific* set of conditions.

That is why Sarco makes all 5 basically *different* types of traps. In a nutshell, it's to assure you of best trapping results at all times, regardless of requirements.

And don't overlook the very important fact that *only* Sarco makes all these 5 types — not merely variations of one type. Therefore, Sarco can give you absolutely impartial trapping recommendations, backed by 43 years of field experience. Call your local Sarco representative or write:

SARCO COMPANY, INC., Empire State Building, New York, N. Y. Represented in Principal Cities.

2083-C

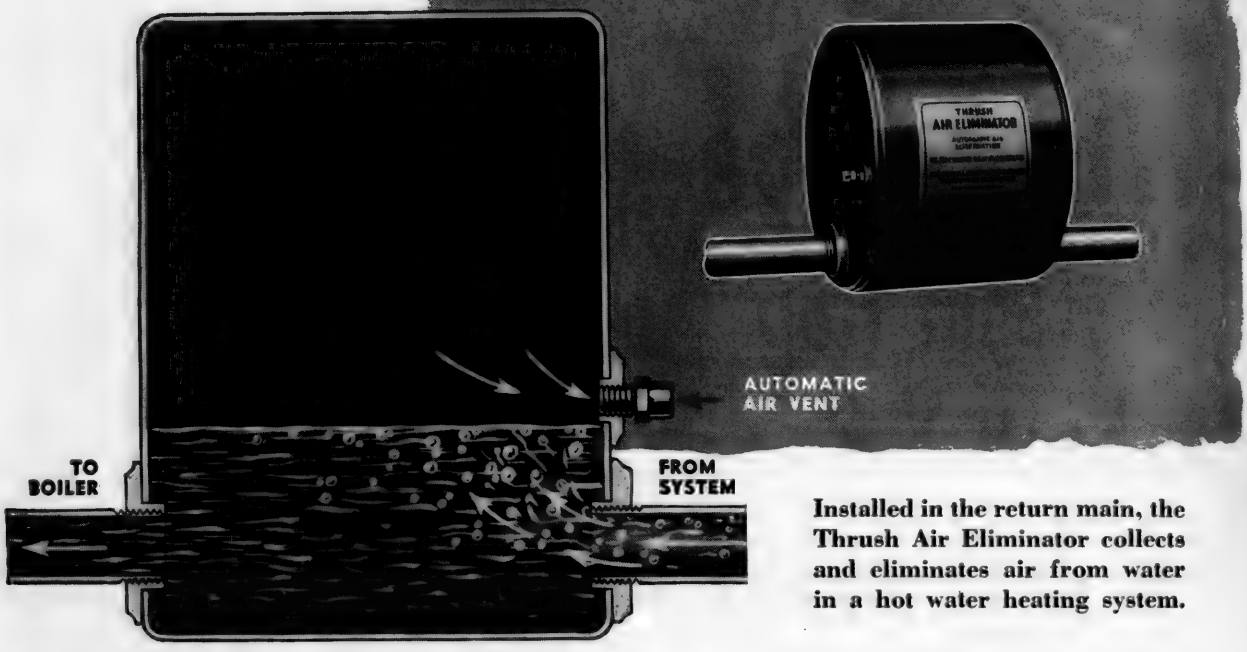
ONLY SARCO makes all 5 types of traps

—not merely variations of one type!

SARCO SAVES STEAM

END *Air Troubles*

IN HOT WATER HEATING

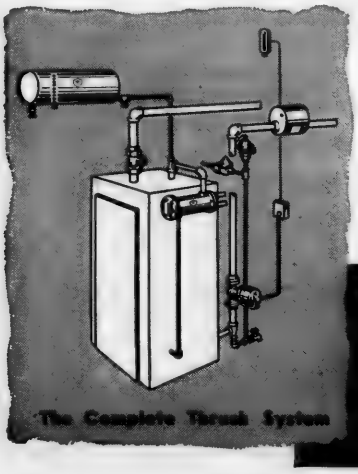


Installed in the return main, the Thrush Air Eliminator collects and eliminates air from water in a hot water heating system.

THRUSH AIR ELIMINATOR

removes air from hot water systems!

THE NEW THRUSH Air Eliminator provides a simple, inexpensive but highly efficient means of collecting and automatically removing air from radiant coils, baseboards or convectors. Air in water moves with circulation and is trapped and released in the Eliminator, thus preventing air from interfering with circulation. This operation is accomplished by breaking the flow of water, which causes air to separate from the water.



The Complete Thrush System

The Thrush Air Eliminator is easy to install in the return main as shown in the system diagram below. It is ruggedly constructed. Each Air Eliminator is shipped in an individual carton, with full instructions.

For real customer satisfaction, install complete Thrush Radiant Hot Water Heat as shown in the illustration at left. For more information see your wholesaler today or write Dept. D-11.

H. A. THRUSH & COMPANY

PERU, INDIANA

more than a million!

YARWAY®

impulse® steam traps

Starting in 1935, this new idea in steam trapping has earned wide acceptance and approval in practically every industry using steam. More than a million Yarway Impulse Steam Traps have now been sold.

Why? Ask any user. You'll hear reasons like these:

"Quick heating. High, even temperatures"

"Low maintenance"

"Small size, light weight"

"Stainless steel body and working parts"

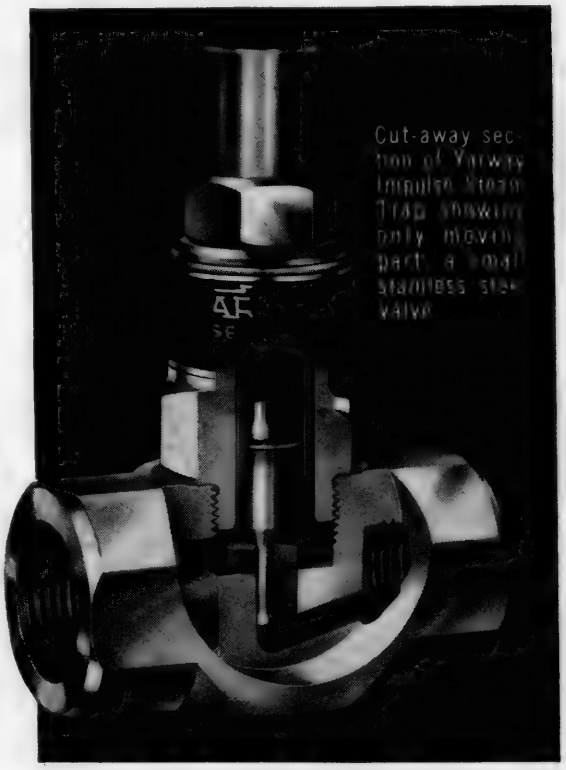
"Good for all pressures"

"Only one moving part"

"Low cost"

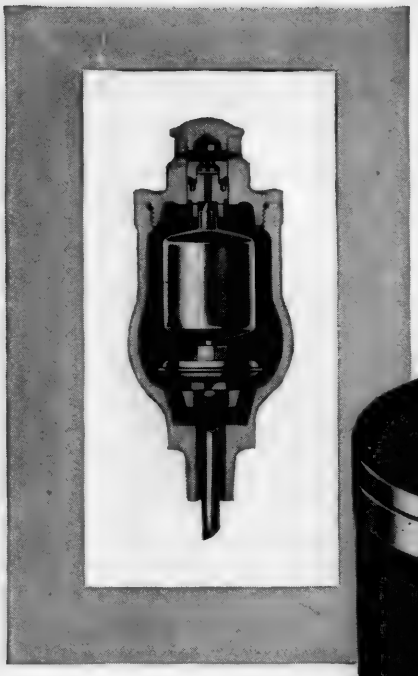
"Immediate delivery from local distributors"

More than 250 Industrial Distributors in the United States and abroad stock and sell Yarways. Write today for the name of the one nearest you.



YARNALL-WARING COMPANY
104 Mermaid Ave., Philadelphia 18, Pa.

® *registered*



A well placed air vent can work a heating miracle!

No. 5 Rapid Vent. Float and thermostatic construction. Designed for use at the end of steam mains, tops of risers and other similar locations on vapor and one pipe vacuum systems where the maximum venting requirement does not exceed one cubic foot per minute at 5 psi.

No. 6 Quick Vent. Thermostatic only. Designed for installation at high points in the piping where there is not sufficient room for the No. 5 Vent or where a float is not needed. Same venting capacity as No. 5.

In a Wilmette Illinois Building, an outwardly well-engineered vacuum system had been a headache for years. Then, last winter, along came a heating man who quickly sized up the situation and said with real conviction: "Put a Marsh No. 5 Vent right there!"

That did it! One inexpensive vent cleaned up a spotty, erratic condition, that a number of expensive alterations had failed to touch.

Unusual? Not in the least: over the years we have seen a lot of wonders worked by installing the right kind of Marsh air vent in the right spot. A number of these dependable vents are illustrated here . . . products that express an unrivaled accumulation of knowledge in dealing with air venting problems.

Marsh air vents are fully covered by the Marsh Heating Specialty Catalog along with Marsh Traps and Valves. Your local Marsh man will be glad to work with you in applying Marsh Vents effectively.

No. 50 Air Vent. Float only. Designed to remove air and gases automatically from hot or cold water tanks, coils or piping, liquid pump systems or similar applications where it is necessary to vent air rapidly. Maximum working pressure, 125 psi.

No. 55 Air Vent. Float and thermostatic construction. Is capable of expelling large volumes of air without passage of water or steam and is designed for use on steam pressure vessels or systems. Maximum working pressure, 125 psi.

No. 7 Air Eliminator. Float and thermostatic construction. Expecially suitable for installation at the ends of steam mains, return piping and tops of risers where it is necessary to expel a large volume of air from the system. Suitable for working pressures up to 15 psi.

MARSH HEATING EQUIPMENT CO.
Sales Affiliate of Jas. P. Marsh Corporation
Dept. U, Skokie, Ill.

MARSH

Quality Heating Specialties since 1865

The NEW 3 R's for CONTINENTAL AIR FILTER USERS

NEW SYNTHETIC MEDIA AROUSES TRADE'S INTEREST

Quick and widespread response to recent introduction of Continental's *new* and *different* DYCON DY filter indicates it fills a long-standing need for a service-easy, clean filter.

NO OIL or MESSY ADHESIVES with DYCON DY!

DYCON DY pricing offers you an advantageous discount. Cut yourself in on this profit-maker. Order your stock today — or write for Bulletin 550 which tells how and why DYCON DY 1-inch filters are a better buy.

with

DYCON TYPE DY 1-INCH DRY AIR FILTERS

AIR CONTINENTAL FILTERS

P.O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.

BARBER COLMAN Electronic Controls

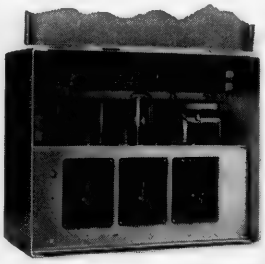
...provide most advanced control systems known today

Hitherto unknown flexibility in control of temperature and humidity is now yours with Barber-Colman's extensive developments in electronic circuits. Fortunately, Barber-Colman started in electronics way back in 1926, when the radio-controlled garage door was pioneered. Then came process controls for textiles, electronic devices for aircraft. From the air, as it were, came the MICRORELAY used in d-c bridge circuits for planes. This ultra sensitive relay is the "heart" of the Barber-Colman amplifier—it reduces number of tubes, substantially decreases plate voltages on tubes (thus increasing tube life), provides stability, maintains control point at 0 volts, is plug-in type for easy servicing. Best of all, the Microrelay requires approximately *1000 times less power* than conventional relays. Here are just a few from the wide range of Barber-Colman electronic devices:

d-c MICRORELAY . . . ultra-sensitive relay—secret of Barber-Colman's superior amplifier!

Electronic Hot Water Controls

FOR OUTDOOR RESET

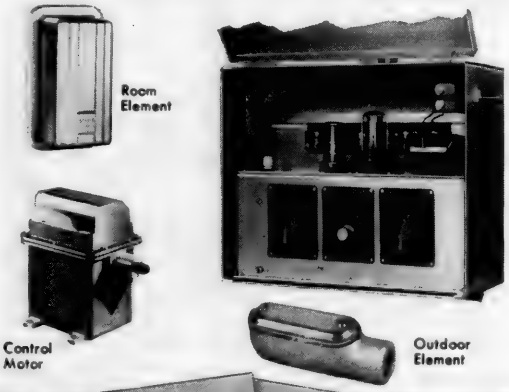


Adjustable Ratio Electronic Control Panel

The most flexible hot water control on the market

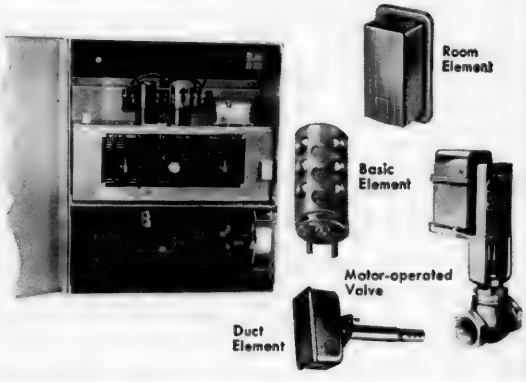
Electronic Temperature Controls

FOR HEATING, VENTILATING AND AIR CONDITIONING



Electronic Humidity Controls

FOR HUMIDIFYING AND DEHUMIDIFYING SYSTEMS



LITERATURE KIT—get latest data bulletins, plus application drawings in this complete electronic literature kit now available to you for the asking. Call our nearby Field Office, or write today.

ENGINEERING ASSISTANCE—in your nearby Barber-Colman Field Office are engineers ready and willing to help you design the very best electronic, electric, or combination electronic-electric control system for each job. Call upon these experts for assistance on control problems.

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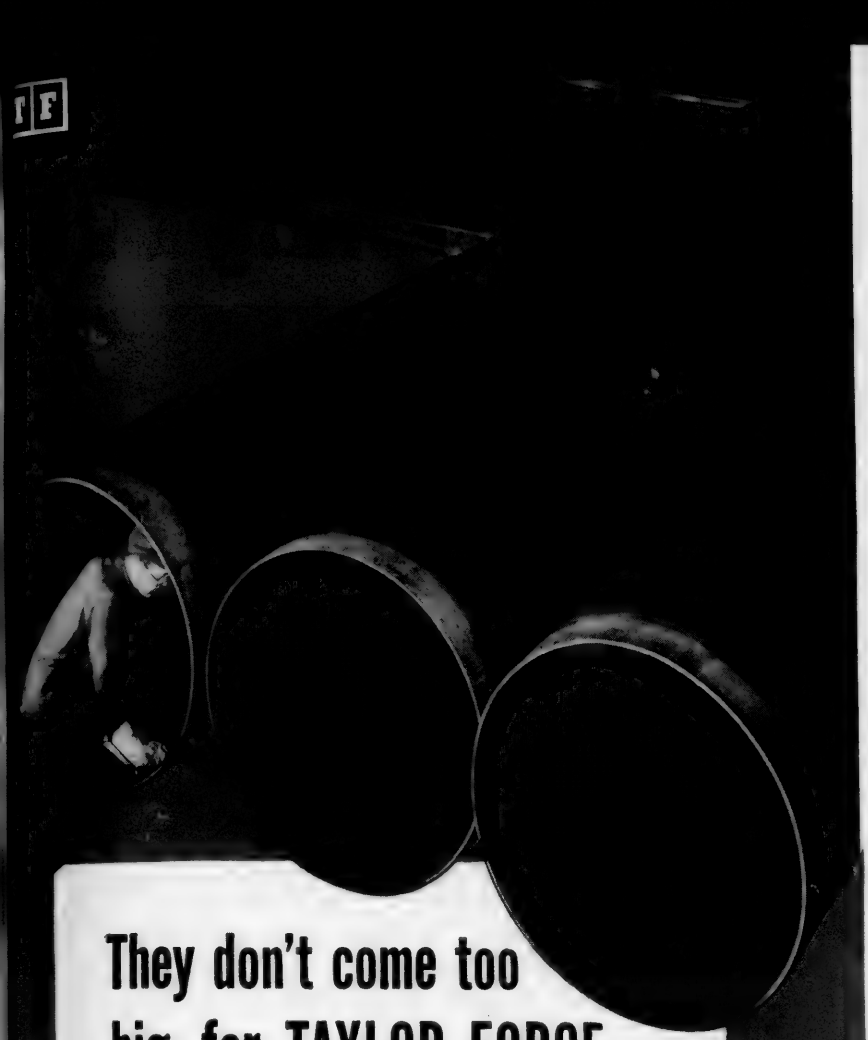
Automatic Controls • Air Distribution Products • Industrial Instruments
Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery



They don't come too big for TAYLOR FORGE

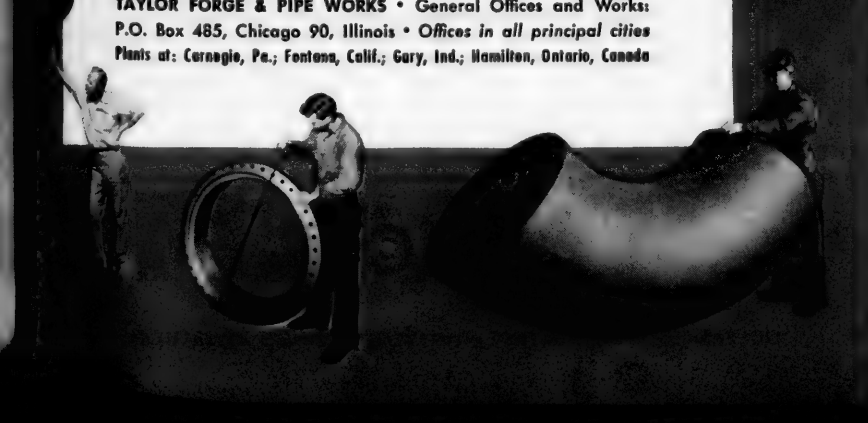
As pioneers in the making of heavy-walled large-diameter pipe, it is not surprising that Taylor Forge has developed the widest range of large welding fittings and flanges like those illustrated here.

In fact, those who know the background of Taylor Forge insist on the WeldELL® line for all requirements from smallest to largest. They have found that WeldELLS have features which are combined in no other fittings for pipe welding.

See your Taylor Forge Distributor for up-to-the-minute facts.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • General Offices and Works: P.O. Box 485, Chicago 90, Illinois • *Offices in all principal cities* Plants at: Carnegie, Pa.; Fontana, Calif.; Gary, Ind.; Hamilton, Ontario, Canada



The pipe was farther along than the auto!

They made their automobiles high in the days when this photo was taken at the old Taylor Forge Works, and that's why Taylor Forge chose this way of demonstrating the largest heavy-walled pipe the world of 1916 had ever known.

As a matter of fact, the pipe was farther along than the automobile; for Taylor Forge had started the manufacture of this large pipe as early as 1907. Before then, pipe had been just a tube for conveying fluids, but by 1907 there was a widespread call for large, rated pipe to withstand widely varied and exacting services.

Taylor Forge responded to this call. In pioneering forged steel flanges, Taylor Forge had learned a lot about forging technique and piping practice...and both schoolings were prerequisite to the new venture. The projected large diameter pipe was to consist of heavy plate rolled into shape, then hammer lap welded to a smooth, sound weld. This called for heavy, specially designed equipment to make the process work and to provide the first *smooth interior* pipe and pressure vessel cylinders produced in this country.

Typical of the pioneering obstacles was the need for a clean flame to prevent scale forming at the weld, but this problem was solved when Mr. J. Hall Taylor designed and installed a large water gas plant that provided the desired welding conditions.

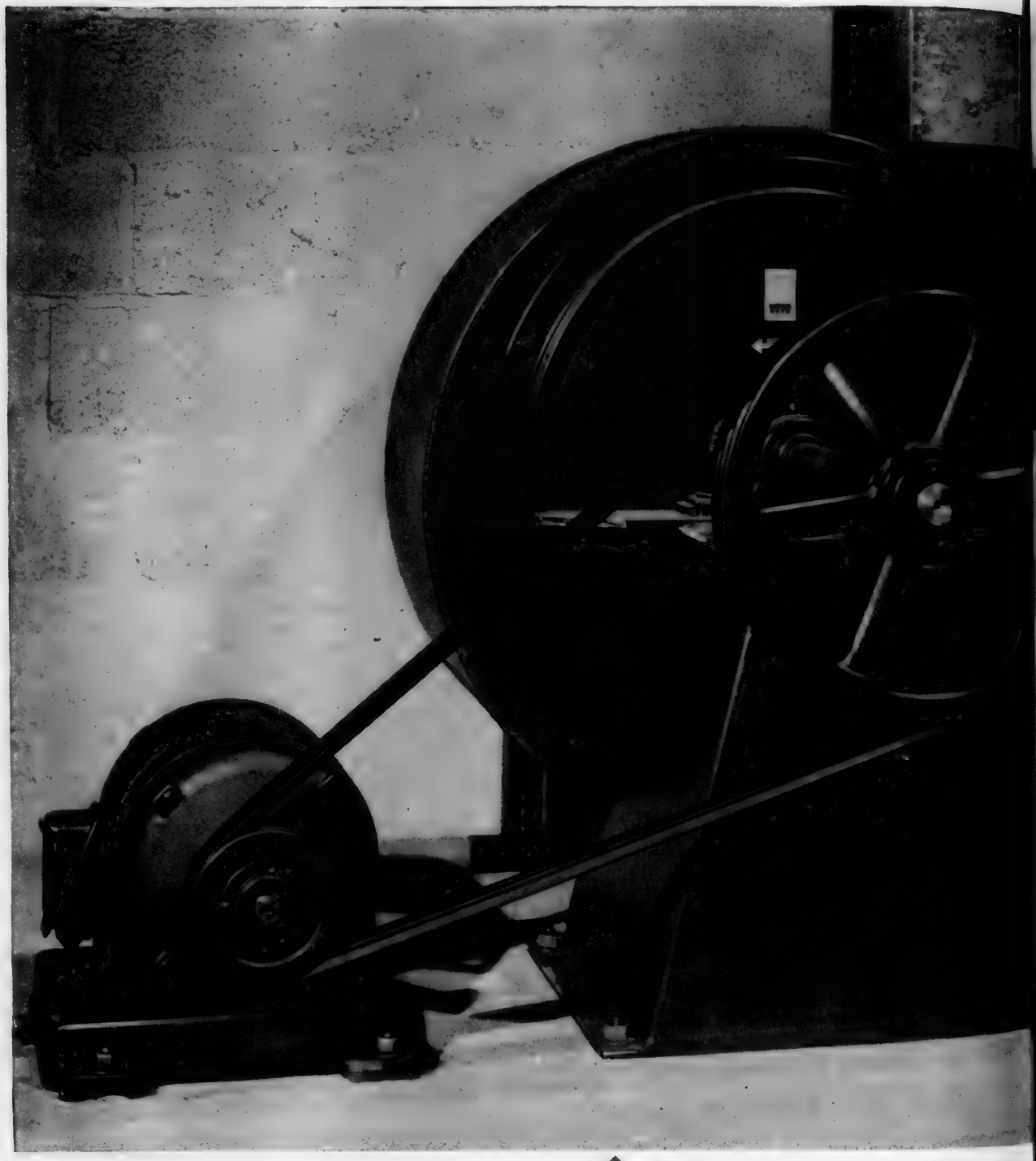
Thus it was that by 1916 Taylor Forge was making pipe up to 96"; forging all types of end joints on it; engineering it and prefabricating it into hydro-electric penstocks; laterals and Y's for pumping stations, pipe lines, and for similar applications all over the world.

Since the introduction of automatic metallic arc-welding this large pipe has been produced as "Taylor Straight Seam Electric-Weld Pipe," but there are hundreds of miles of the old "Taylor Hammer Lap Welded Pipe" still giving as good service as it did the day it was installed.

An episode in the story of Taylor Forge leadership in designed piping

This old painting—the original in full color—depicted the original process of making Taylor hammer lap welded pipe.

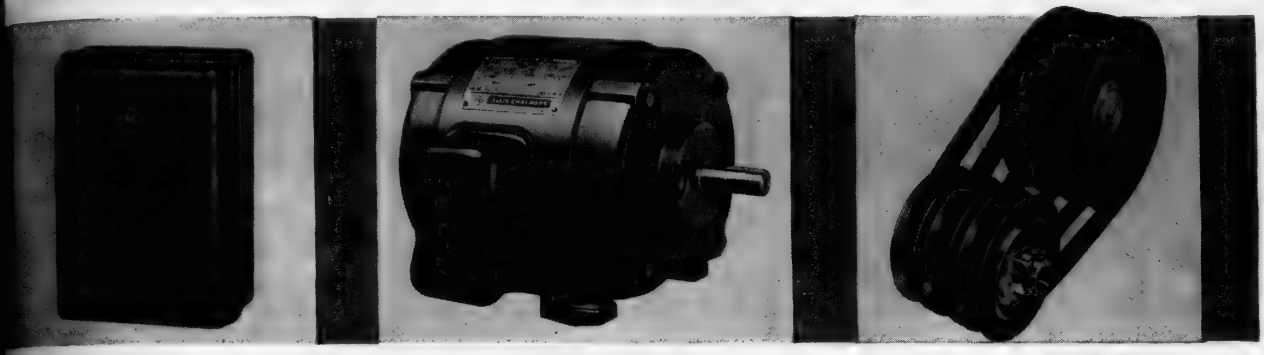
CUT Engineering and



ALLIS-

Installation TIME

with A-C Complete Service— from Power Line to Driven Shaft



CONTROL **MOTOR** ***Texrope* DRIVE**

ALLIS-CHALMERS CONTROL-MOTOR-DRIVE COMPONENTS are engineered for you . . . to your specific job! All you have to do is call one of the experienced A-C distributors or representatives near you. He'll save you hours of engineering time! You'll save hours of installation time, too. There's no worry about coordinating three sources of supply . . . there's no worry about whether the components will work together.

With the Allis-Chalmers control-motor-drive combination, one reliable supplier guarantees the complete drive. If you need service, the A-C Certified Service Shop near you will take care of it promptly.

Lower your engineering and installation costs . . . get one source guarantee and reliability . . . see your local Allis-Chalmers representative for an A-C control-motor-drive for your next job.

Ample NATION-WIDE STOCKS

A large stock of control-motor-drive equipment commonly used in air conditioning installations is maintained by Allis-Chalmers district offices and Authorized Distributors. In addition, an efficient warehouse inventory system locates seldom-called-for items within hours after you call. You get immediate action when you specify Allis-Chalmers equipment.

Nation-Wide CERTIFIED SERVICE

North, South, East or West . . . there's an A-C Certified Service Shop near you. A-C Certified Service Shops are independent shops which meet strict Allis-Chalmers standards for modern equipment, efficient methods, and business integrity. These shops assure your customers factory-approved parts, equipment, and fast, efficient service.

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- ☐ Handy Guide to Starters — 14B7733
- ☐ Reduced Voltage Starters — 14B7215

***Texrope* DRIVES**

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CHALMERS

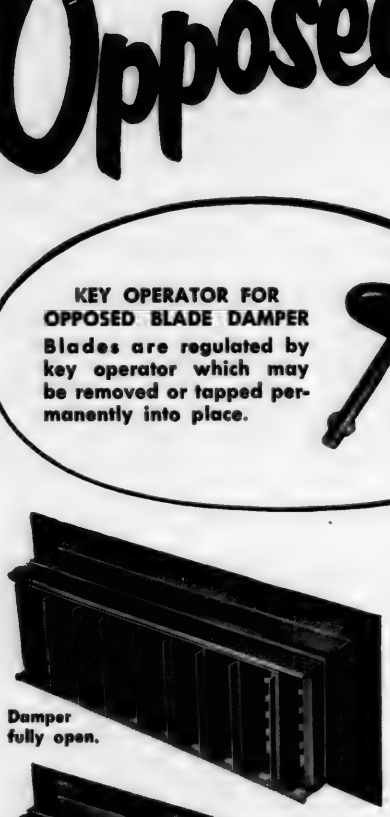
TRI-FLEX and AEROVANE REGISTERS *equipped with*

Opposed Blade Dampers

Showing TRI-FLEX T-647 Double Deflection Register with Opposed Blade Damper

KEY OPERATOR FOR OPPOSED BLADE DAMPER

Blades are regulated by key operator which may be removed or tapped permanently into place.



Damper fully open.

Damper partially open.

Damper fully closed.

TRI-FLEX Supply Air Registers and AEROVANE Return Air Registers — specified and installed on important air conditioning jobs — are constructed with opposed blade dampers.

This improved damper unit insures uniform distribution of air over the entire face of the register . . . and provides positive damper setting in any position from fully open to fully closed regardless of system pressure. Set in a rigid steel frame, blades are formed for extra strength and stiffness, and overlap when closed, eliminating any possibility of air leakage. Blades are regulated through the face of the register by means of a key operator which may be removed or tapped permanently into place.

For complete information and size selection data for TRI-FLEX and AEROVANE Registers and Grilles, write for a copy of Catalog No. 200.

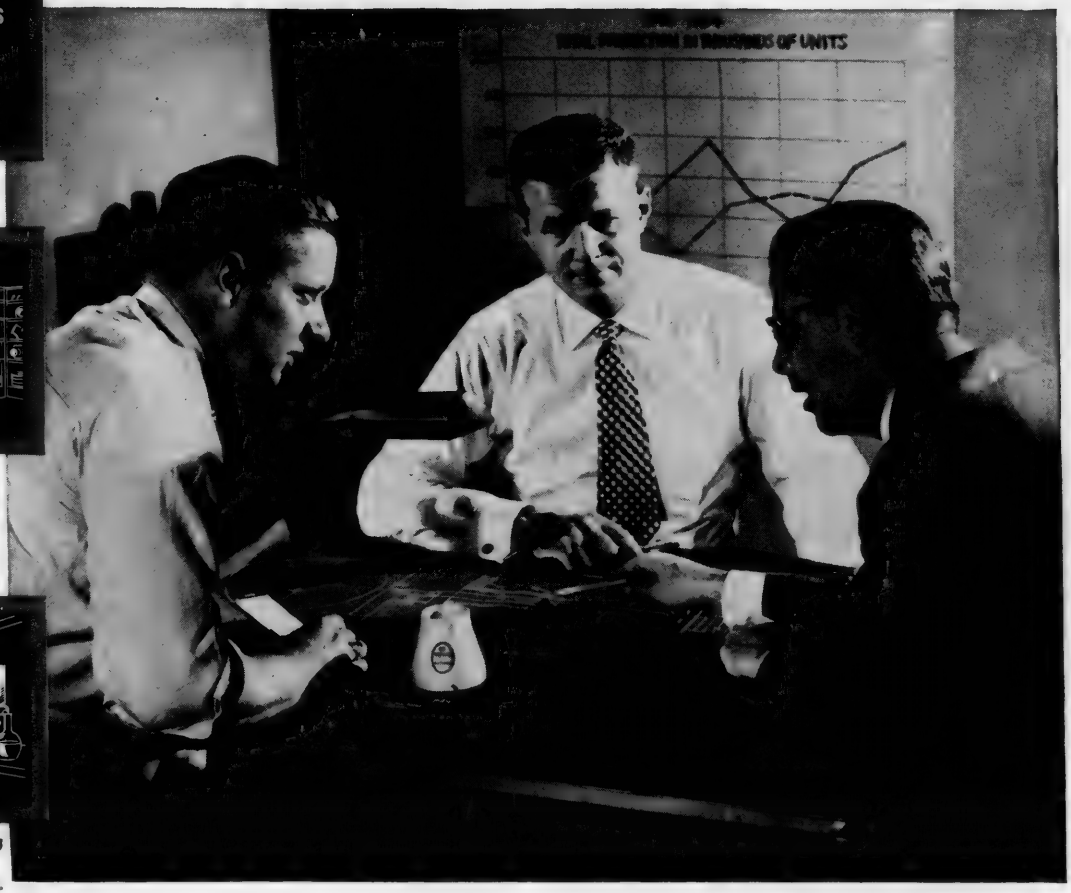
TUTTLE & BAILEY INC

NEW BRITAIN, CONNECTICUT

WHY IT PAYS TO DO BUSINESS WITH THE LEADER

Tube Turns' nearby complete stock SAVES YOUR PURCHASING TIME.

Tube Turns' pioneering research GIVES YOU ADVANCED PRODUCTS.



Tube Turns' engineering help GIVES YOU COST-CUTTING IDEAS.

Looking for *more for your money?*

HERE'S HELP ON PIPING PROBLEMS!

You can make piping dollars go further by doing business with your Tube Turns' distributor. For it is through this nearby source that you have access to the world-famous Engineering Service Division of Tube Turns. The help of its experienced engineers often saves thousands of dollars in piping costs.

You get this service and other important plus values only when you purchase TUBE-TURN* Welding Fittings and Flanges. Your Tube Turns' distributor has the world's most complete line to match your needs and save your time.

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The Leading Manufacturer of Welding Fittings and Flanges

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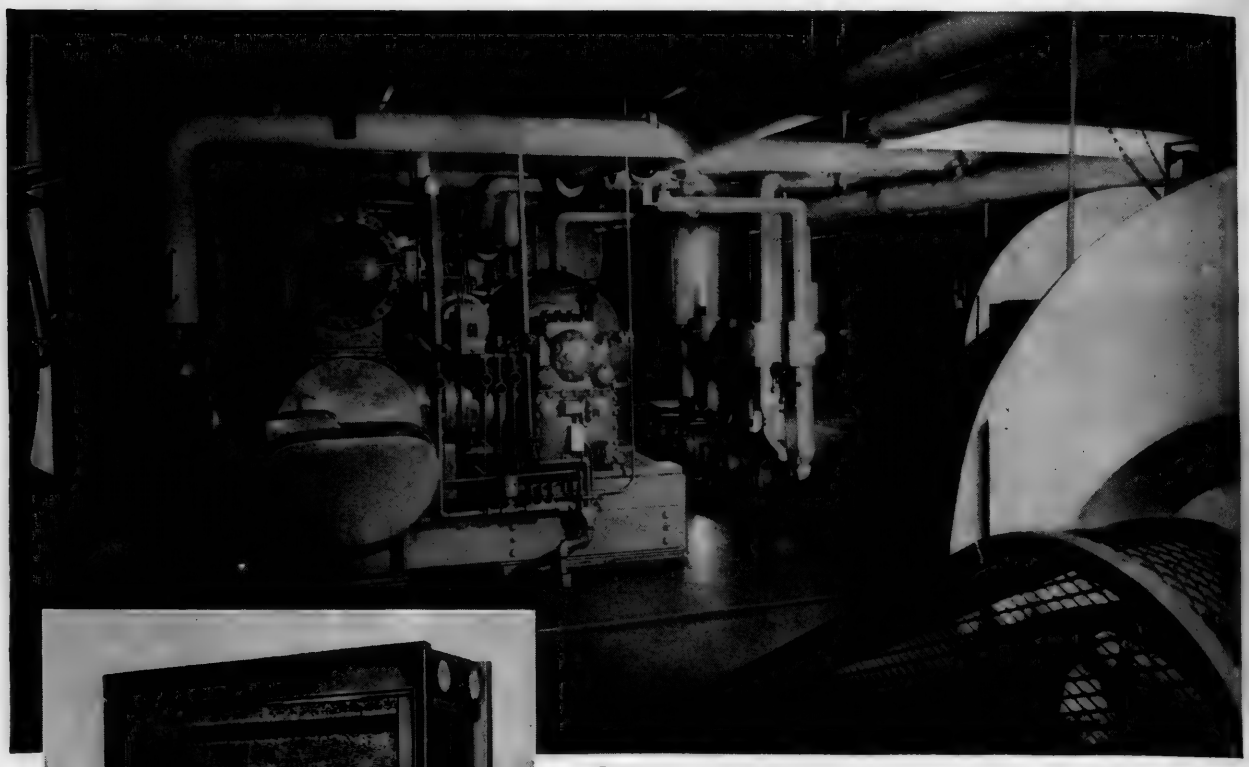


Equipment room of Neisner's Rochester, N. Y. store where conditioned air is filtered in 3 units, each consisting of 2 sections, of Staynew Automatic Filters.

STAYNEW Automatic
Self Cleaning Type Filter

Where Automatic Filters are used

Neisner's Specify STAYNEW For Air Conditioned Stores

More consistent filtration . . . more efficient operation . . . more effective control of dirt and dust in sales area than conventional filters. *ALL* good reasons why Neisner Brothers Inc., national retail chain, specified Staynew Automatic Air Filters in their large post war stores.

Staynew Automatic Air Filters adapt themselves to all types of air conditioning systems—cooling, either by direct expansion or chilled water; heating, or refrigeration. Self cleaning and easily supervised by laymen, Staynew Automatics stay on the job 24 hours a day at peak efficiency.

Let Staynew show you how to filter larger volumes of air at *lower* cost. Write for descriptive folder.

REPRESENTATIVES IN PRINCIPAL CITIES

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

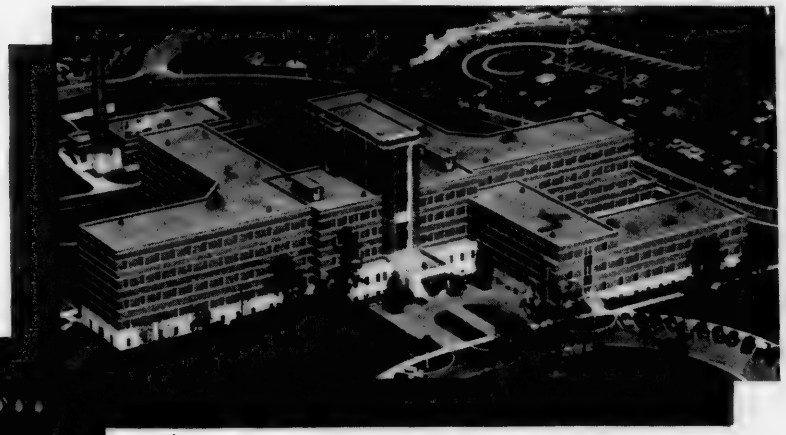
DOLLINGER CORPORATION

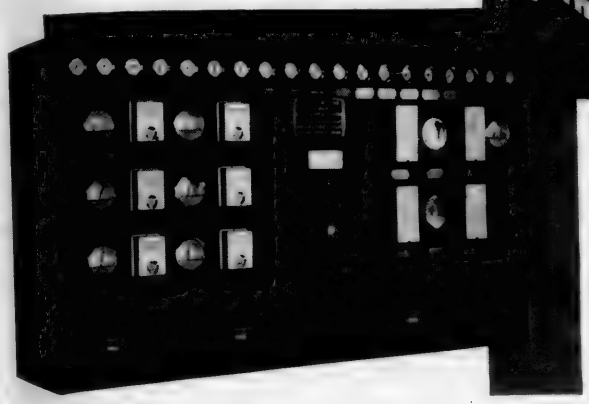
15 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

EVERY ROOM WEATHER-PERFECT!

it's another
Air Conditioned Hospital
with
JOHNSON CONTROL





The Moses H. Cone Memorial Hospital, Greensboro, N. C. Samuel Hannaford and Sons, architects, Cincinnati, Ohio; Loewenstein-Atkinson Associates, supervising architects, Greensboro; Watson and Hart, mechanical engineers, Greensboro; W. H. Singleton Co., Inc., heating and air conditioning contractors, Arlington, Va.

Left, panel-mounted Johnson Control System automatically regulates the temperature and humidity of the primary air supply for room air conditioning units.

In the modern 300-bed Moses H. Cone Memorial Hospital, correct temperatures and humidities for every need are effortlessly and accurately provided by an up-to-the-minute system of Johnson Automatic Temperature and Humidity Control.

Four Johnson controlled year 'round air conditioning systems serve the vital areas, dining rooms and canteens. Strategically located Johnson *Individual Room* Thermostats and Room Humidostats respond instantly and continuously to the most exacting demands in the operating rooms, delivery rooms, nurseries and other vital areas. Optimum temperatures and humidities prevail constantly.

In the patients' rooms, Johnson Heating-Cooling Thermostats regulate Water Valves on the supply of hot and cold water in Carrier Weathermaster room air conditioning units, maintaining each room at precisely the prescribed temperature. In addition to this *individual room* control, behind the scenes Johnson Master-Submaster Control regulates the temperature and humidity of the large primary air system which supplies the individual room units.

Johnson Control, throughout the entire hospital, produces maximum comfort and faster recovery for patients, permits hospital personnel to concentrate on technical duties and insures the greatest return from every dollar spent for heating and cooling. Above all, *pneumatically operated* Johnson Control is completely safe, *even in the presence of explosive anesthetic gases.* And Johnson Humidity Control guards against static electricity.

Any building—small or large, new or existing—can enjoy the unique comfort and fuel saving advantages of a Johnson-engineered temperature control system. Whatever your control problem, it will pay you to talk it over with an engineer from a nearby Johnson branch. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

Johnson Thermostats and Humidostats insure optimum temperatures and humidities in nurseries, operating rooms and other vital spaces.

Each patient room is maintained at the desired temperature level by Johnson Thermostats and Valves controlling the room air conditioning units.

V-152 Water Valve and T-271 Heating-Cooling Thermostat, both specially designed to regulate unit air conditioners.

JOHNSON CONTROL

TEMPERATURE AIR CONDITIONING

MANUFACTURING • PLANNING • INSTALLING • SINCE 1885

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POWER ROOF VENTILATOR

CARNES

Another outstanding

ROOF VENTILATOR *from*

CARNES *. . . the newly designed*

MODEL CL
CENTRIFUGAL

- LOWER SILHOUETTE
- WIDER CAPACITY RANGE

This newest roof ventilator from Carnes is designed to provide a low contour for today's low parapet buildings . . . and to deliver all these fine features: Wide range of capacities; all aluminum construction; quiet operation; heavy-duty, ball-bearing protected motors; precision balanced fan wheels and efficient trouble-free service.

CAPACITIES—300 to 6000 C.F.M.
WHEEL SIZE—5" through 24"

And . . . the new MODEL B *centrifugal —*

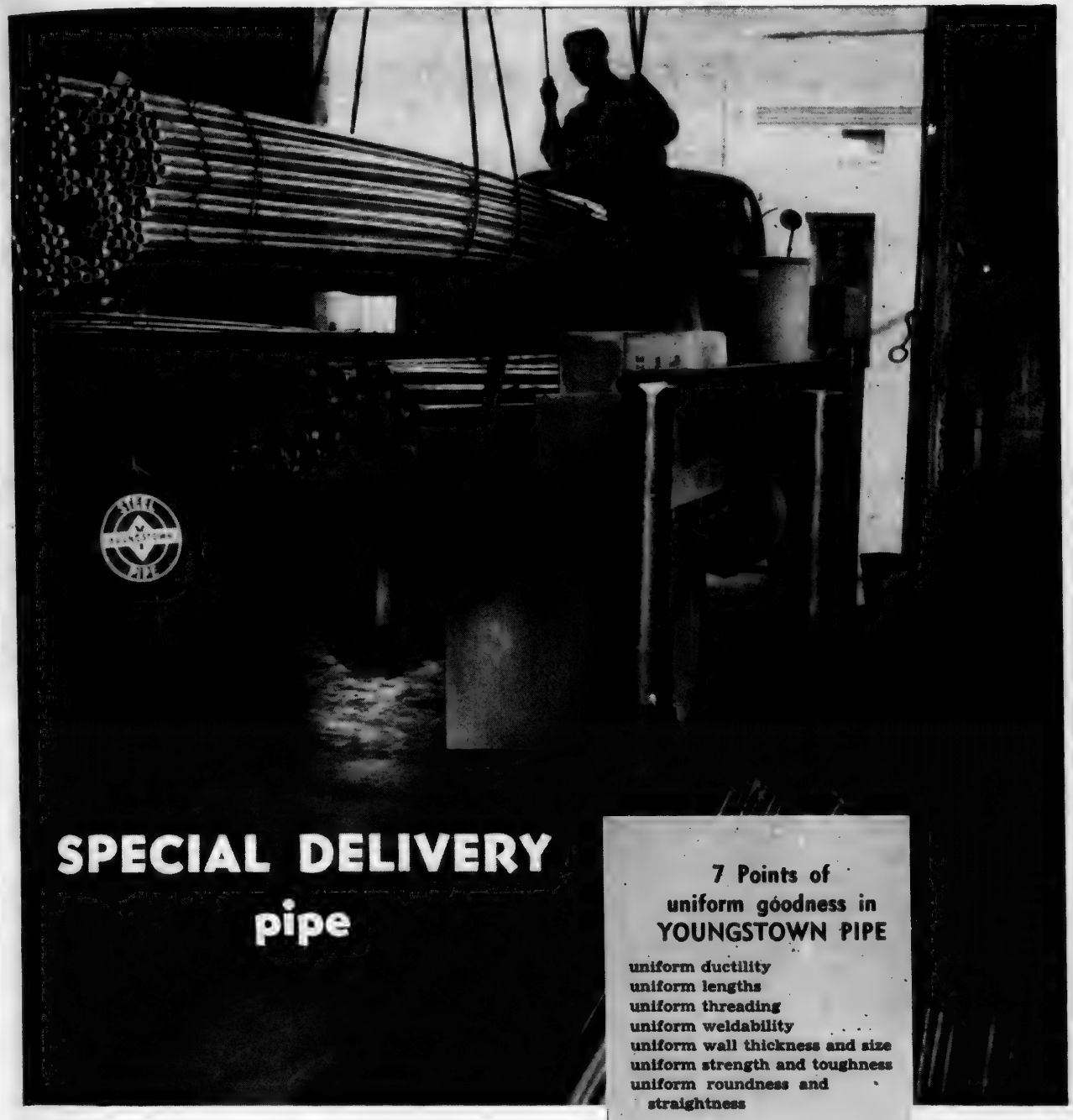
A completely new ventilator, belt-driven for flexibility of fan speed . . . motors mounted on vibration-eliminators . . . low silhouette . . . aluminum housings are standard, with galvanized copper or stainless steel available . . . large capacity . . . hinged motor hood . . . precision-built fan wheels balanced both statically and dynamically.

CAPACITIES—1300 to 40,000 C.F.M.

WHEEL SIZE—12" through 60"

CARNES The Most Talked About Name in Air Distribution

CARNES CORPORATION - Verona, Wisconsin



SPECIAL DELIVERY pipe

7 Points of uniform goodness in YOUNGSTOWN PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

It's SPECIAL DELIVERY all the way when you order pipe from your Youngstown Pipe Distributor. In no time at all, he's got your order loaded and speeding to your door — or wherever you want it — any size — any amount!

Youngstown

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

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SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES

Trane Fans and Coils have more features that give you

Greater efficiency... compactness in your built-up

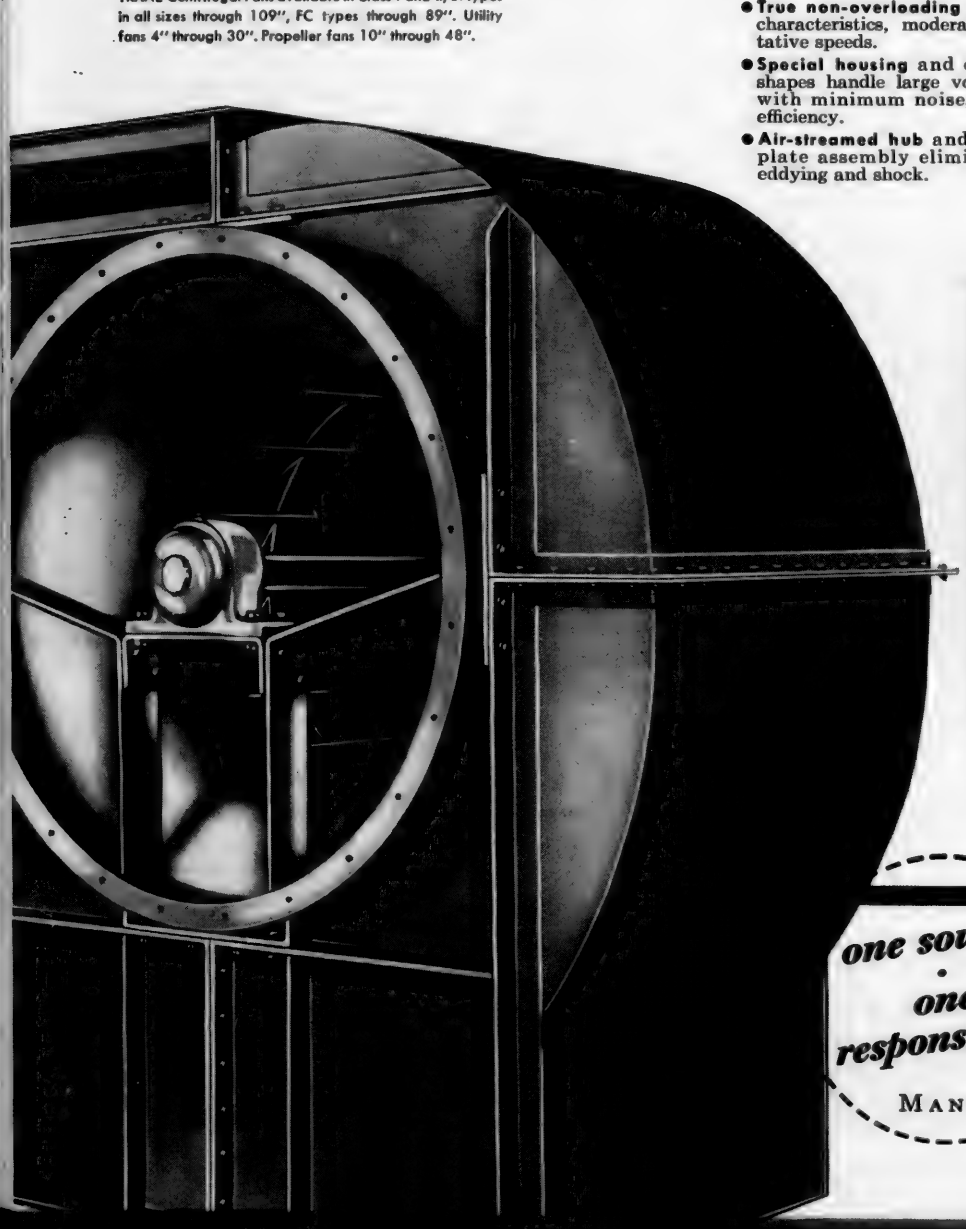
Handle bigger jobs with more compact equipment... get greater reliability, too!

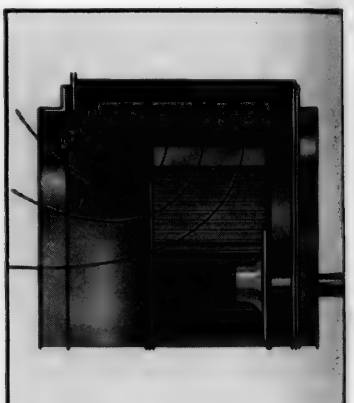
The efficiency features of TRANE Fans and Coils can make a *big* difference in your built-up systems! For example, the TRANE Delta-Flo Fin and mechanical fin-to-tube bond not only give you a more *efficient* coil, but actually form a stronger, more rigid unit than heretofore possible. And even that is only part of the story.

TRANE Centrifugal Fans available in Class I and II, BI types in all sizes through 109", FC types through 89". Utility fans 4" through 30". Propeller fans 10" through 48".

Compare Trane with any other fans

- **True non-overloading** power characteristics, moderate rotative speeds.
- **Special housing** and outlet shapes handle large volumes with minimum noise, high efficiency.
- **Air-streamed hub** and back plate assembly eliminates eddying and shock.
- **Fan wheel balanced** dynamically and statically with electronic balancing equipment.
- **Rugged housing** of lock-seam construction (small fans), welded construction (large fans) resists damage.
- **Proved performance** backed by over a quarter of a century of fan building experience.





Streamlined inlet cone distributes air evenly in fan wheel without noisy turbulence. Permits fan to operate at high efficiency with low noise level.

one source • one responsibility

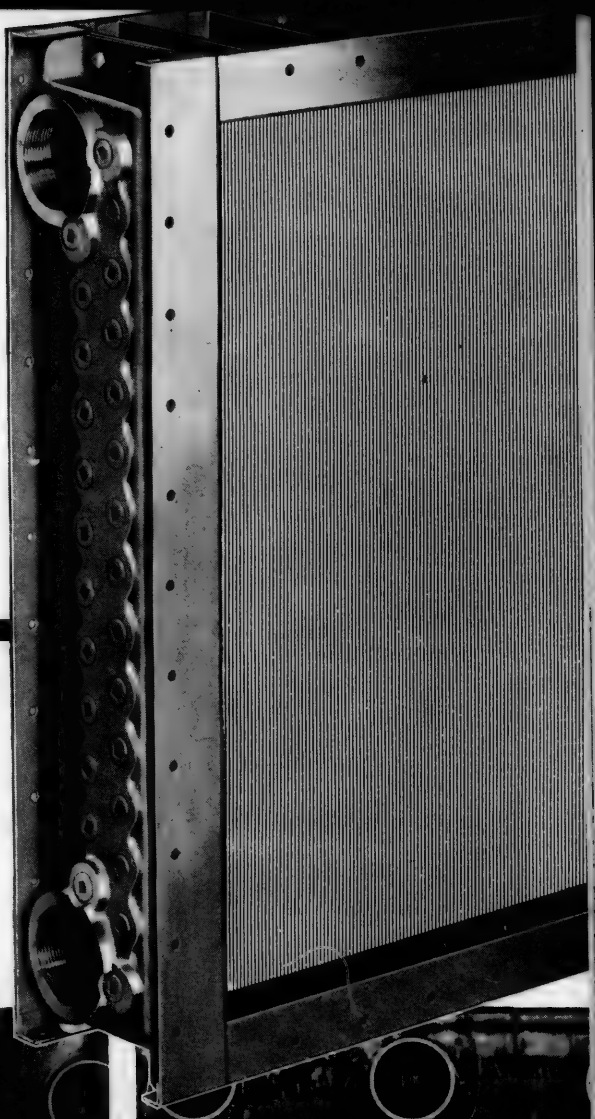
Install

MANUFACTURING ENGINEERS

The Trane Company

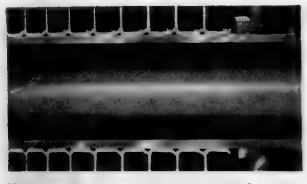
durability . . .
systems

Every TRANE feature—from the accurately streamlined fan inlet to the exclusive kinetic orifice—has been *proved in actual application.* You know you can count on TRANE Fans and Coils for efficiency, durability and compactness *before* you order! For details see your nearest TRANE Sales Office or write TRANE, La Crosse, Wis.



Compare Trane with any other coils

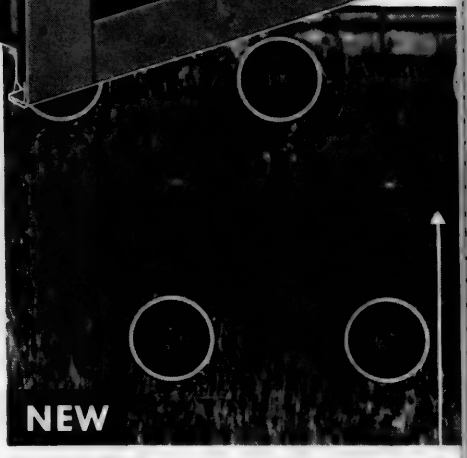
- **Accurate ratings** proved by over twenty-five years of field and laboratory testing.
- **Exclusive dual fin** contact assures high heat transfer, greater strength.
- **Greater rigidity** assured by the formed delta ridge of the new Delta-Flo Fin.
- **Low air friction** of plate type fin offers minimum air resistance.
- **High coil capacity** yet wide fin spacing.
- **25% more effective** use of the fin surface.
- **More uniform heat** transfer over entire surface of the fin.



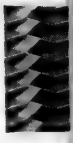
Mechanical fin-to-tube bond is as strong as though fin and tube were one. Wide, flat collar forms generous heat transfer area.

Kinetic orifice on SD coils releases steam in the direction of the condensate flow. Accelerates condensate flow, guards against freezing.

Old plate fin. With flat fin design, turbulence is concentrated behind each tube as shown by this unretouched laboratory test photo. Since turbulence is concentrated, a large part of the fin area produces little heat transfer.



New Delta-Flo Fin. Delta-shaped ridge just ahead of each row of tubes extends turbulence over *entire fin surface* for uniform-heat transfer. Unretouched test photo shows how every inch of fin surface contributes to heat transfer.



TRANE **Fans and Coils** *for efficient built-up systems*

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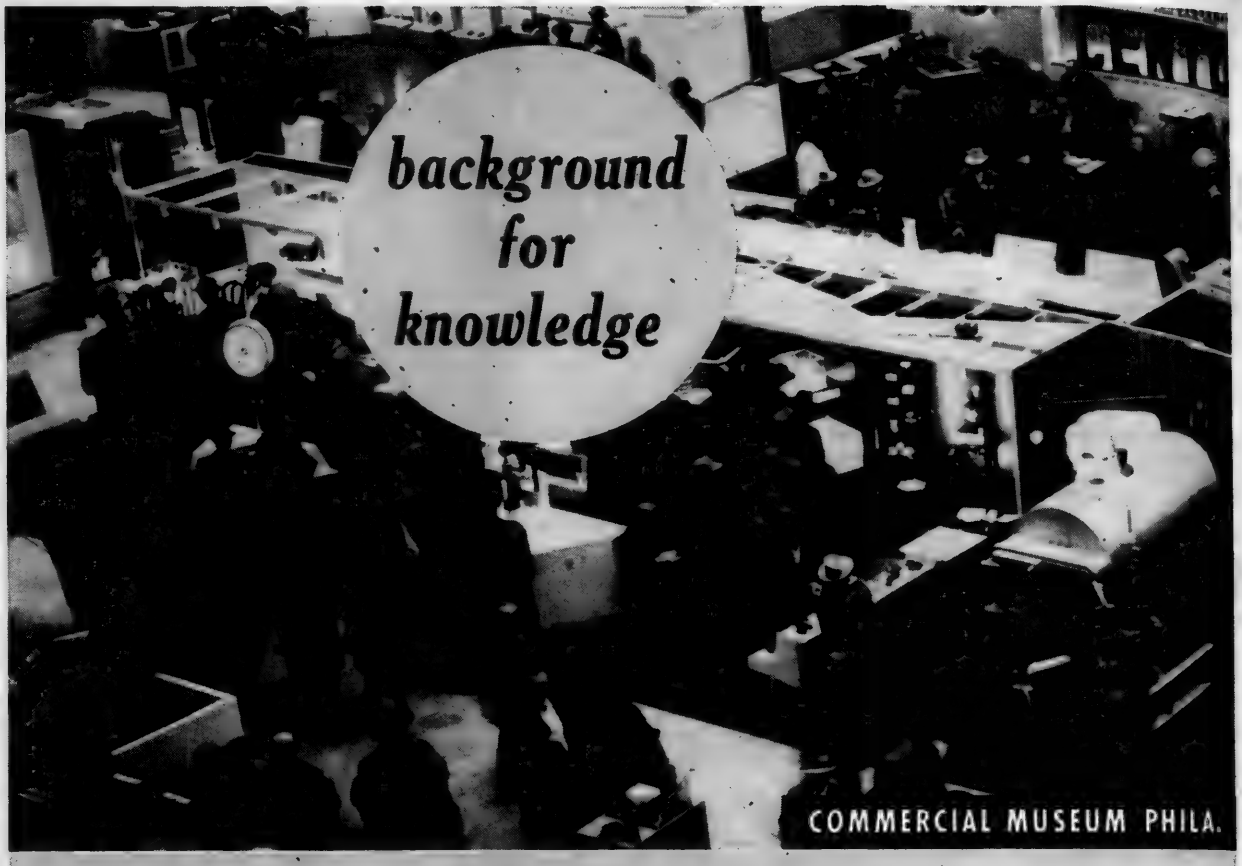
La Crosse, Wis. • Eastern Mfg. Div., Scranton, Pa. • Trane Co. of Canada, Ltd., Toronto • 90 U.S. and 15 Canadian Offices



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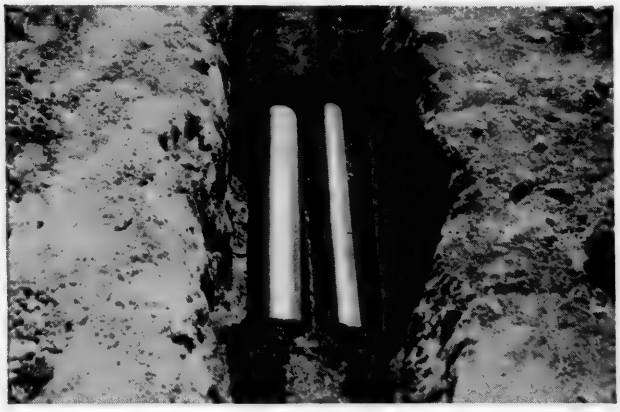
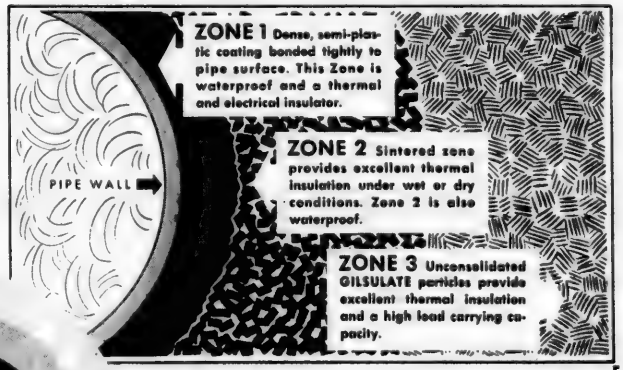
1. GILSULATE—Easy to install—Just pour it on, tamp it down and backfill. Run heat through the pipes (up to 520°F)...and the job is completed. No need to remove rocks from backfill; no problems of cramped space or multiple piping.

more and more hot underground pipe gets insulated



2. GILSULATE—Cost Less per Installed Linear Foot—No skilled labor needed...requires no mechanical sheaths, special protective devices, or costly installation procedures.

with new modern <u>triple-zone</u> GILSULATE®


ZONE 1 Dense, semi-plastic coating bonded tightly to pipe surface. This Zone is waterproof and a thermal and electrical insulator.
ZONE 2 Sintered zone provides excellent thermal insulation under wet or dry conditions. Zone 2 is also waterproof.
ZONE 3 Unconsolidated GILSULATE particles provide excellent thermal insulation and a high load carrying capacity.
PIPE WALL

3. GILSULATE—Delivers Permanent Triple-Zone Protection—Three tough, massive circular sheaths completely and permanently protect the pipe, cut heat loss down to 8% to 11% of bare buried pipe. Triple-zone protects against all buried line corrosion conditions: water, roots, acid, alkalis, bacteria, etc.

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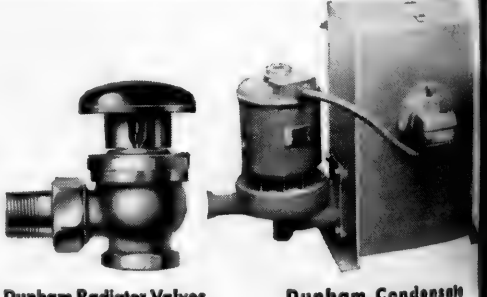
From radiator traps to fully engineered systems you can DEPEND ON DUNHAM for everything you need in heating



Dunham Radiator Valves. Complete line of radiator valves, traps and other specialties for steam heating.

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Your clients can cut their fuel costs too and enjoy comfortable heating with Dunham Vari-Vac . . . a versatile heating system that has proved time and again that fuel savings as high as 40% are not at all uncommon.

For you see . . . Dunham patented temperature controls on variable vacuum steam mains can lower fuel bills on *any* building . . . regardless of *size, type, age or location.* With Vari-Vac, outside weather conditions and inside heat losses promptly and automatically control steam consumption so that you need less steam for more comfortable heating. What's more, you can "zone heat" with Vari-Vac to meet varying conditions of building exposure and occupancy.

There's far more to both the cost-saving and comfort features of Dunham Vari-Vac. For full information, write for bulletin 2101-A. C. A. Dunham Company, Dept. HV-11, 400 W. Madison Street, Chicago 6, Illinois.

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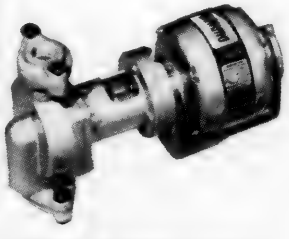
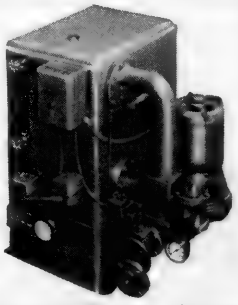


Dunham Circulators. Heart of Dunham's complete hot water line. Single-spring motor coupling. Brand-name motor.

Dunham Unit Heaters. Line includes heating-cooling units, vertical, horizontal discharge and large blower unit heaters.

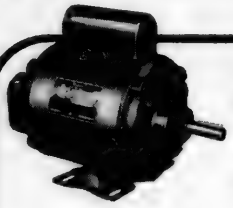


Dunham Vacuum Heating Pumps. Single and Duplex models. No close clearance parts. Only one moving element.

Wagner capacitor-start induction motors are the *right kind* of motors to use for most single-phase applications. They have become first choice of many leading manufacturers of air conditioners, refrigerators, freezers, water pumps, and motor-driven tools, and are used in many other similar fractional or integral horsepower applications.

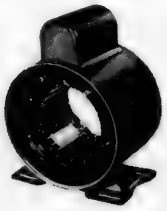
These motors offer low maintenance cost—only a minimum of servicing is required—and they give many years of reliable service with unusual freedom from vibration and noise.

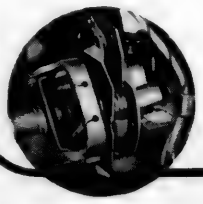
Pictured above is the Wagner Type RK, resilient-mounted capacitor-start induction motor in the new 56 frame that is used for ⅓, ½ and ¾ hp ratings. Smaller fractional ratings, and integral sizes from 1 through 5 hp, are also available.



Wagner rigid base Type RK motor, in the new 56 frame size. The formed steel base is securely welded to the rolled steel frame to produce a strong, rigid mount that will not get out of alignment.

Frames for these motors are made of thick rolled steel, with machined beads which accurately position the end plates. The frames have no openings, and are treated inside and out to prevent rusting.





These motors are equipped with the Wagner quick-break switch that disconnects the starting winding and capacitor from the line when the motor approaches operating speed. It operates over a million times without trouble.

Wagner Electric Corporation
EST. 1891

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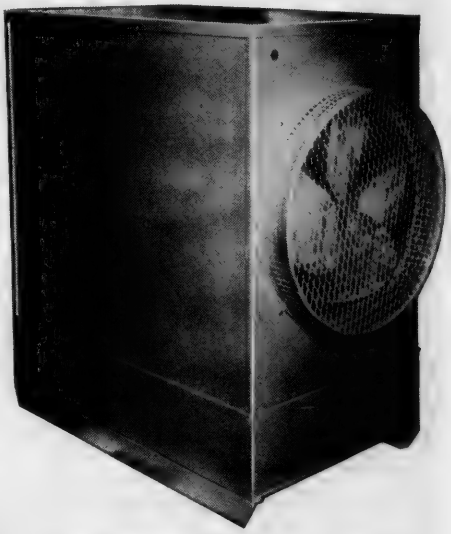
The wetted deck surface of BUSH Propeller-Fan cooling towers is made from all-heart Redwood fill . . . nail-less . . . to assure long life and trouble-free operation. This hard, durable wood needs no artificial treatment to resist fungus deterioration.

- **Available in a capacity range from 2 to 15 tons for both residential and commercial air conditioning applications.**
- **Panels are of galvanneal, specially coated for all-weather protection and continued attractive appearance. Panels are first zinc chromate prime coated inside and out . . . then rubber coated inside and coated outside with Vinyl-base paint of high chlorinated rubber content.**
- **BUSH Propeller-Fan cooling towers are attractive in appearance . . . have clean-lined contours . . . no bulky projections.**
- **All motors are totally enclosed and have built-in overload protection. Standard motors are 110 volts, single phase, 60 cycle.**
- **Motors, fans and drives are of sufficient capacity to handle average ductwork for indoor installation if desired.**
- **Distribution pan, top and fan guard are all easily removable for quick access to all internal parts.**



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TYPE "VC"

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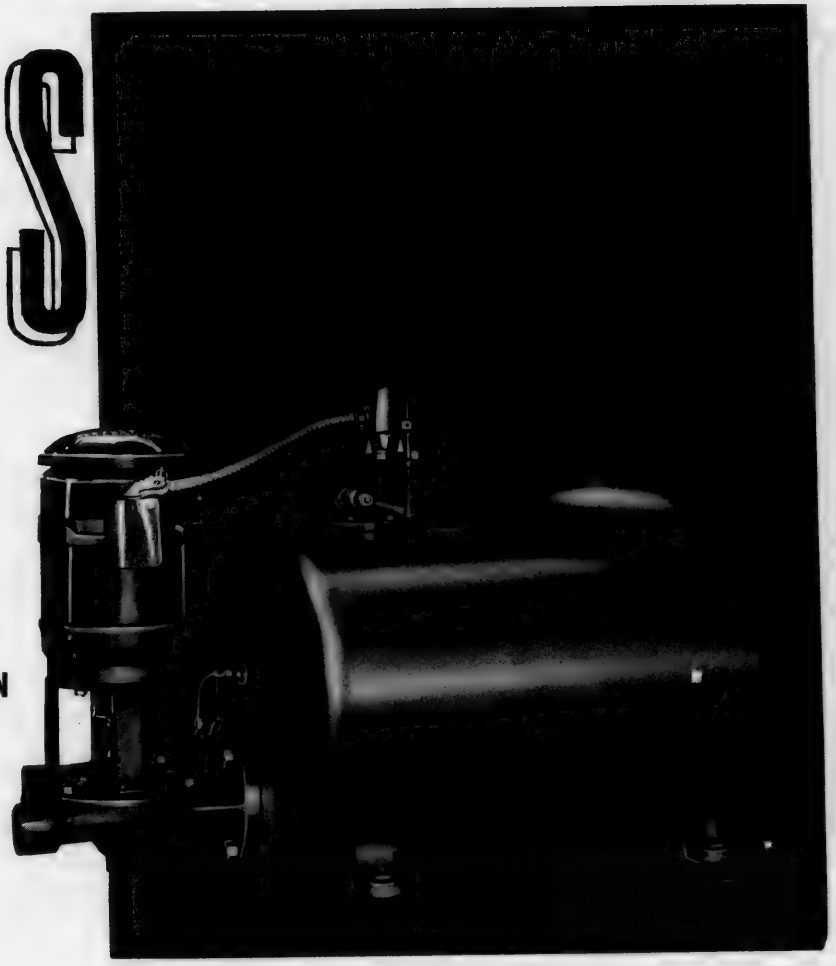
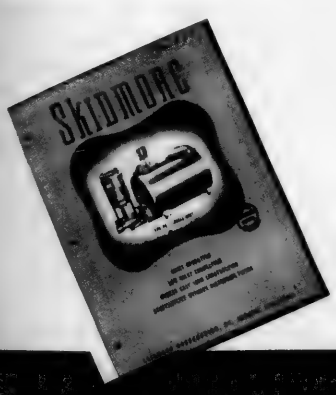
EASILY ACCESSIBLE



YOUR COPY — Send today for bulletin 10-B. Complete information and engineering data are enclosed.



Designed by men who really know pumps . . . men who have had years of experience in the field—the "VC" Condensation Pump is built for rugged and dependable service. Like all SKIDMORE PUMPS, the "VC" Unit is correct in every detail . . . yet simple in construction —assuring ease of accessibility and a minimum of wear. Specify a SKIDMORE PUMP on that next job . . . there's one for every installation.

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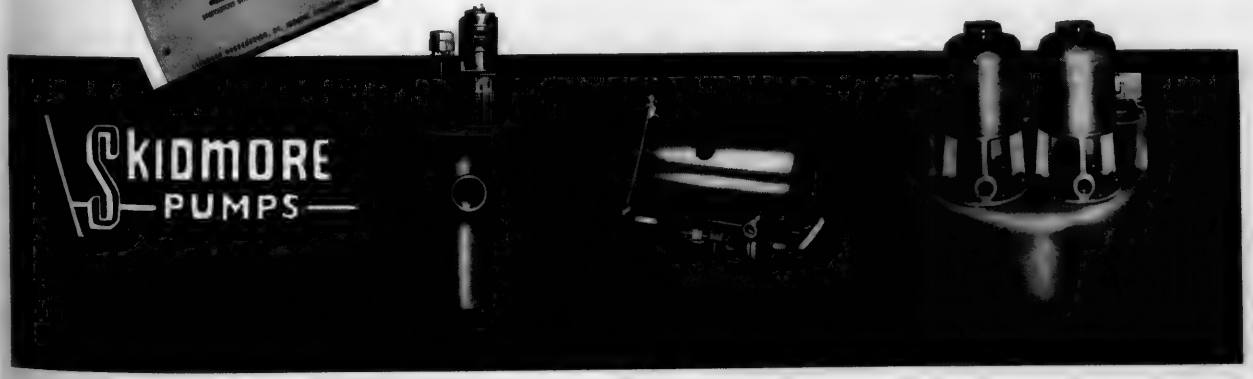

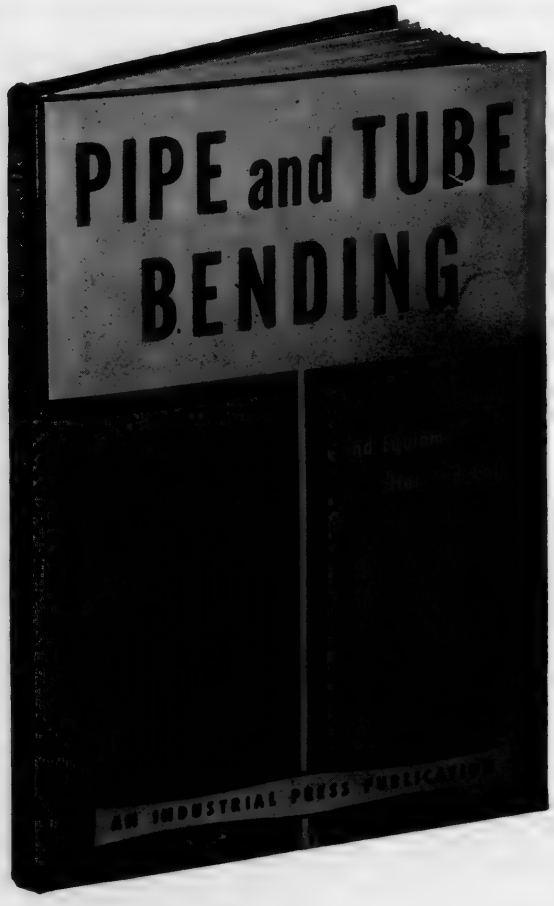

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Are you faced with a difficult problem in the bending of pipe or tube? Would you like to know which of the many different bending methods in use could be efficiently applied to your particular job? If you had the opportunity to look over the outstanding types of bending equipment which are now available and to study the operating characteristics of each would it save you time, money and headaches?

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Covering equipment and methods for pipe bending both in the shop and in the field, ***Pipe and Tube Bending*** **illustrates the outstanding types of bending equipment which are available, describes the operating characteristics of each, and shows how each is applied to particular jobs. With this information, it is possible to compare methods and equipment and select those which are most suitable for a particular job.**

In addition, ***Pipe and Tube Bending*** **gives convenient formulas for determining length and minimum radii of bends, shows the effect the method of bending has on minimum radii, discusses in detail the use of fillers, mandrels, dies, etc.**

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- Methods of Bending
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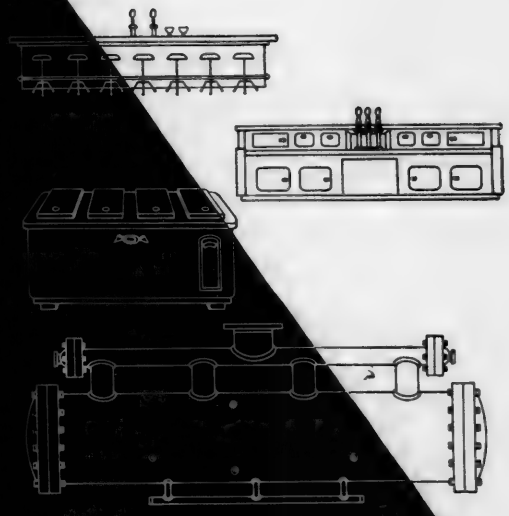

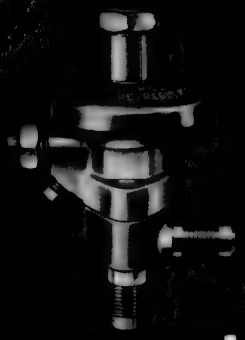

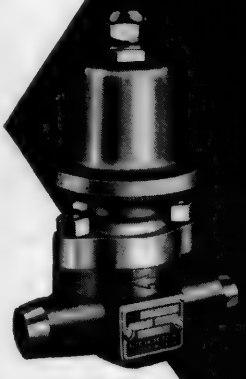

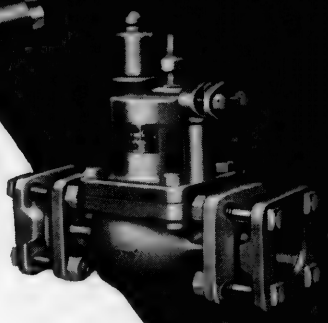

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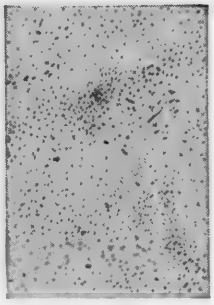
Random Thoughts from a Filter Engineer

by Frank Purvis

- **WORLD'S MOST EFFICIENT FILTER PANEL WON'T ALWAYS CATCH THIS DIRT**
- **THE PRICE OF A PUSH-BUTTON AGE**
- **MORE PROTECTION FOR FILTER PANELS**

WORLD'S MOST EFFICIENT FILTER PANEL WON'T ALWAYS CATCH THIS DIRT



We hear a lot of talk about filter efficiency these days and we think it's a good thing. But it seems odd to pay so much attention to the efficiency of the filter and then lose all you've gained and more by not installing the filter properly.

No filter is any better than its seal. If dirty air escapes around the perimeter of the filter panel, you're not getting the efficiency the manufacturer built into the filter. The same may be said for a filter panel that doesn't set square in its frame, or one that has faulty holding devices. All the air is not passing through the filter media so all the dirt can't be removed.

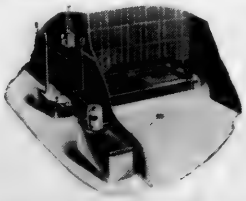
It's a little like being very careful to lock the front door while the back door stands wide open. It nullifies the extra filter efficiency manufacturers have built into a filter.

This may seem a bit obvious and, actually, it is. But it's a common mistake and one which can be costly. So we pass it along for what it's worth.

THE PRICE OF A PUSH-BUTTON AGE

The trend is to automatic. That's part of our push-button age. The more automatic an operation is, the prouder we are. But push-button operation is a mixed blessing. Is it better to do more by hand and pay less for controls? Or pay more for controls and save man-hours?

A buyer has to answer this one for himself. But so far as cleaning and oiling our Electromaze electronic air cleaner goes, the buyer has a wide choice. We offer manual cleaning and oiling at lowest cost; a semi-automatic service system for those who want to pay a little more and do a little less; and an automatic service system for those who want a complete push-button operation.



Cutaway view of typical Electromaze assembly with semi-automatic service system.

We think the semi-automatic service system strikes a nice compromise and may be just the ticket for many of our customers. A turn of a crank propels a series of jets back and forth underneath the Electromaze. Vertical streams of water clean the filter, then vertical streams of oil renew the adhesive. Where it might take a man a full day to clean the average installation manually, he can do it in about ten minutes with the semi-automatic system.

And it's easy as A, B, C to operate. After turning off ventilating blower and Electromaze, turn on the washer water. Slowly turn the washer crank until the spray unit has made about fifteen passes in each direction. After the washing cycle is completed, and the Electromaze cells are dry, turn on the oil pump. Then turn the crank as before and drive the spray unit to the opposite end and back, making one pass in each direction. Switch off the oil pump and that's all there is to it.

MORE PROTECTION FOR FILTER PANELS

Most everyone knows filter panels lead a rugged life. Some of them have to live with corrosives. Some with high temperatures. And often they're banged around quite a bit. Any of these things can cause the paint to chip or peel.

We try to avoid this by protecting our Air-Maze filter panels with a new synthetic coating that gives more protection than ordinary enamels or paint. It costs us a little more but, because it's more durable, we think it's worth it.

We hope nobody ever wants to remove this coating from one of our filter panels because it's hard to take off even in a stripping tank.

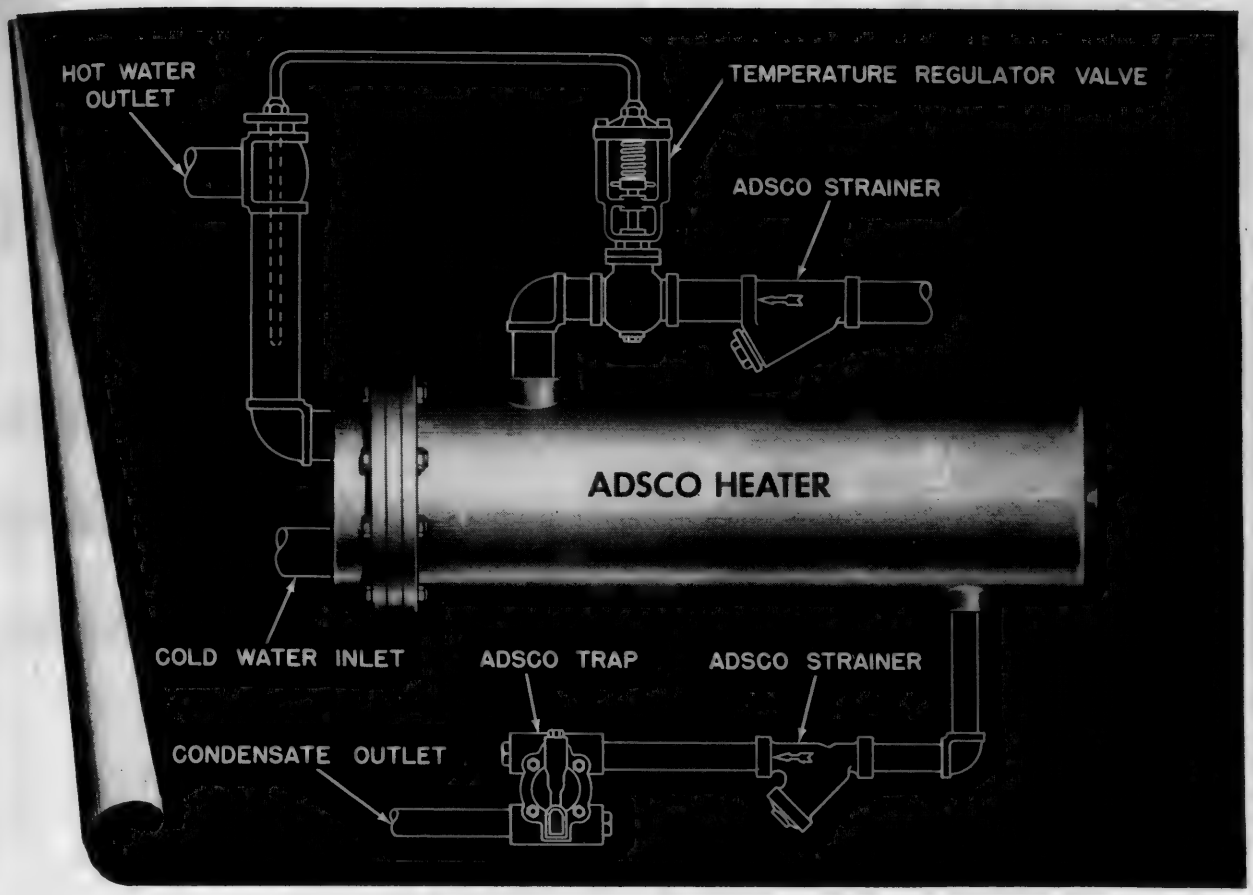
Infrared lamps drying paint on section of filter framework.

This special coating is just one of many little "extras" we build into our filter panels and holding frames. Separately, they're not of vital importance. Together, we think they make a big difference. The Air-Maze Corporation, 25000 Miles Avenue, Cleveland 28, Ohio.

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS



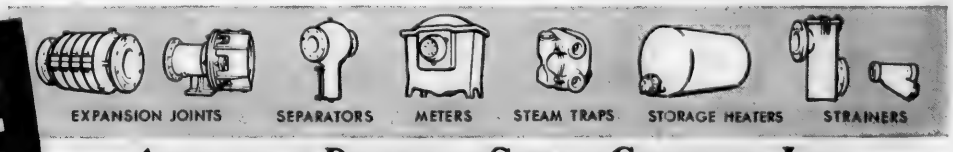
BLUEPRINT FOR ACTION!

And what action, when you use an ADSCO Water Heater! Hot water . . . when and where you want it . . . and at low cost! ADSCO Instantaneous Heaters furnish industry with general service hot water, boiler feed water, and process water. They supply hotels, apartments, office buildings, dormitories, hospitals, and institutions with hot water for showers, washrooms, dishwashers, laundries, and for general cleaning. ADSCO Convertors, a type of instantaneous heater with a shorter temperature range, furnish *all types* of buildings with hot water for quiet, trouble-free space heating systems.

Yes, you get plenty of action — fast action — out of ADSCO Water Heaters. They operate best when connected according to the typical piping arrangement shown above, with two ADSCO Y-type Strainers to protect valuable equipment and an ADSCO Dual Steam Trap to handle condensate efficiently.

ADSCO Water Heaters have only three parts: shell, tube bundle, and cover. All are made to ADSCO's high standards. Steel shells are seamless steel pipe, carefully cut and welded by skilled workmen. The shell flange is sturdy and accurately machined and all openings are precisely located. The tube bundles are made of pure, deoxidized seamless copper tubes formed into U-bends. By means of electrically and automatically controlled equipment, they are rolled and expanded into carefully drilled tube sheets which have a diamond pitch arrangement for spacing of tubes. The semi-steel covers are high-tensile, fine-grain castings.

For further information, write for Bulletin 35-78 on Instantaneous Heaters or Bulletin 35-77 on Convertors.



ADSCO ENGINEERED PRODUCTS

AMERICAN DISTRICT STEAM COMPANY, INC.

GENERAL OFFICES
NORTH TONAWANDA, NEW YORK
PLANTS: NORTH TONAWANDA, N. Y., AND RICHMOND, CALIF.

OVER 21,000,000

MULTI-DUTY AIR FILTERS IN AUTOMOTIVE NEW PLANT

NEW MODELS in automotive manufacturing and assembly plants are featuring *clean air* to help insure body finishes free from imperfections; protect precision production operations against the destructive action of dust and dirt; provide better working conditions. To achieve these benefits, plant ventilation systems are being installed that require the automatic, high efficiency cleaning of tremendous air volumes.

Over the past 21 months American Air Filter has supplied for this service Multi-Duty Self-Cleaning Filters totaling over 21,000,000 cubic feet of air per minute. Such overwhelming product acceptance by an industry noted for its progressiveness and exacting standards best tells the story of Multi-Duty's high efficiency and dependable, trouble-free performance.

If you want clean air in large or small volume, automatically and economically, ask your local AAF representative for complete Multi-Duty data. It's the pioneer with the proven record—a record which each year emphasizes the fact that Multi-Duty is America's "most specified" automatic, self-cleaning air filter.

AAF

herman nelson

American Air Filter

COMPANY, INC.

294 Central Avenue, Louisville 8, Kentucky

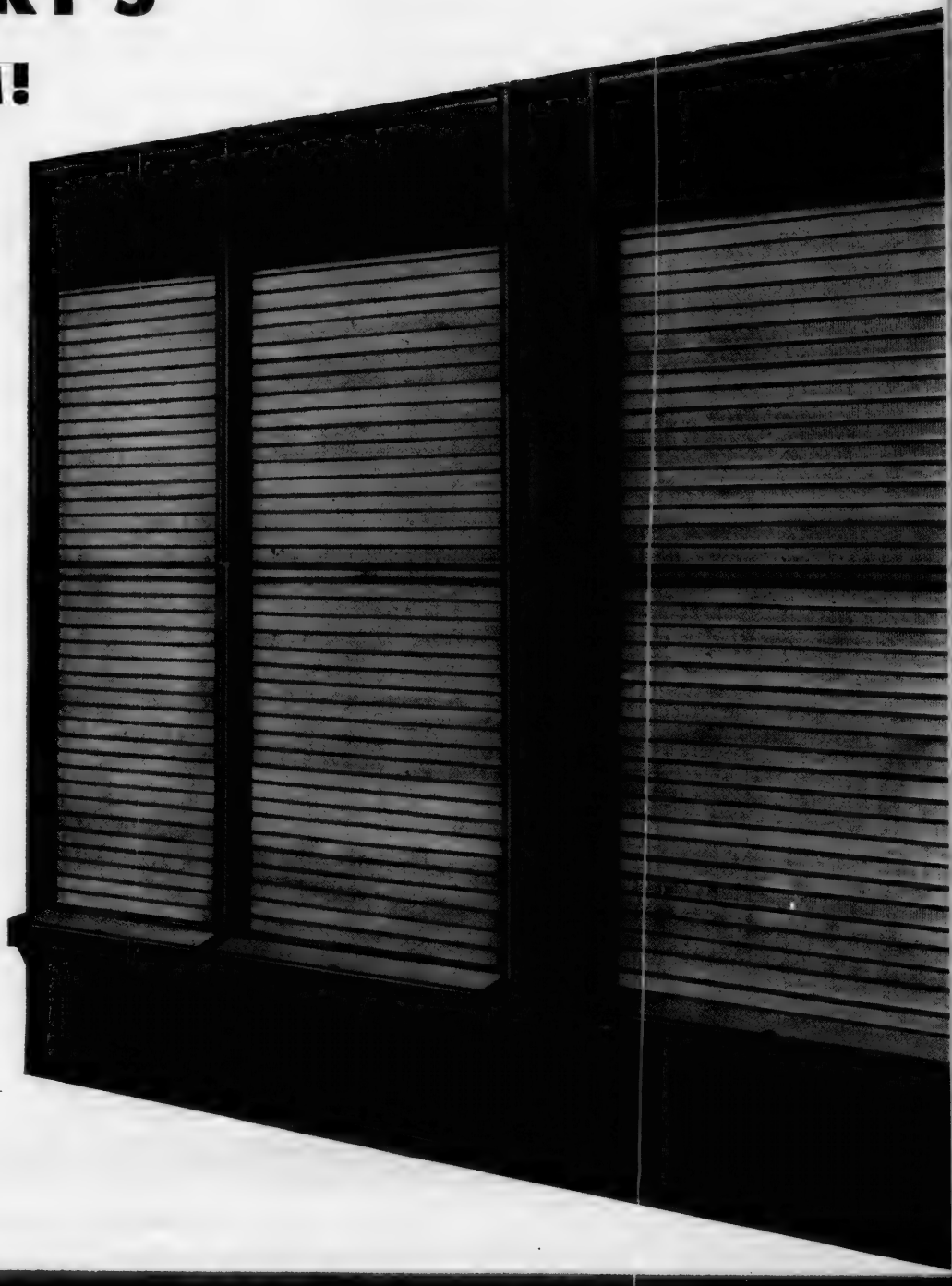
American Air Filter of Canada, Ltd., Montreal, P. Q.

cfm IN 21 MONTHS!

OVERWHELMING FAVORITE

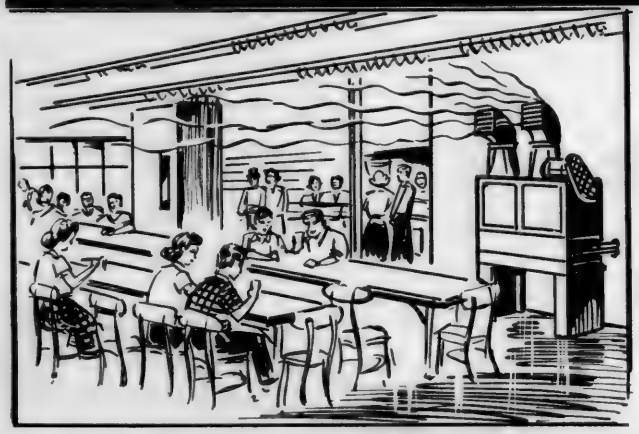
INDUSTRY'S

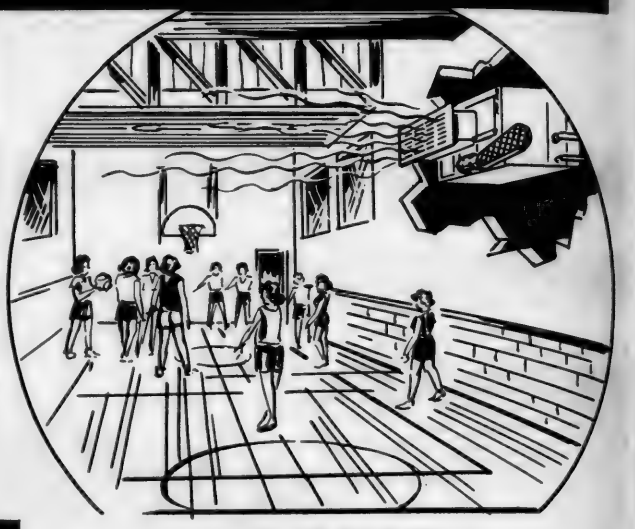
PROGRAM!



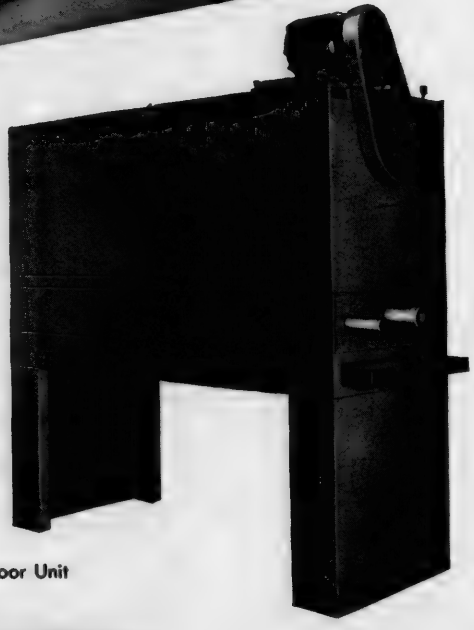
KENNARD Engineered

HEATING AND VENTILATING BLOWER UNITS





Wall or Ceiling Unit



Floor Unit

for SCHOOL...

AUDITORIUMS • CAFETERIAS • GYMNASIUMS
MANUAL TRAINING ROOMS
Models for Factories • Offices • Stores

Floor, Wall or Ceiling Arrangements, these units can be furnished with tempering or heating coils or combination of both for use with hot water or steam and the accessories for controlling, filtering and directing air flow.

There is a Kennard H & V Unit that will fit your requirement of heating and filtering recirculated air, fresh air, a mixture of both or for ventilation only.

TYPICAL CAPACITIES

Unit No.	CFM at 800 FPM Coil Face Velocity	CFM at 500 FPM Coil Face Velocity	Maximum BTU Capacity 2 Row Coil
107	864	540	59,700
108	1,264	790	87,300
110	1,832	1,145	126,800
111	2,896	1,810	199,800
210	4,000	2,500	276,700
211	5,696	3,560	392,900
213	6,880	4,300	475,500
215	8,936	5,585	616,700
216	10,336	6,460	713,700
218	12,680	7,925	875,100
220	15,000	9,375	1,035,500
223	19,800	12,375	1,366,900
226	28,800	18,000	1,988,400

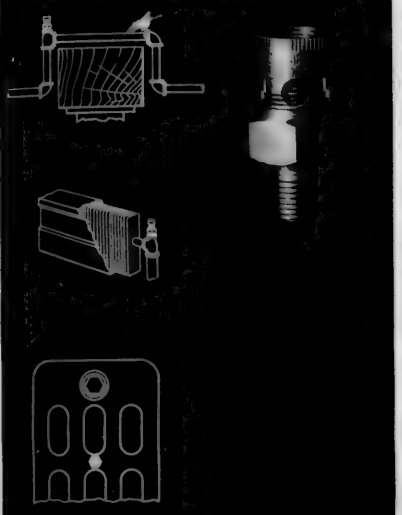
Write for Bulletin HV-1A

KENNARD CORPORATION
1823 HANLEY RD. • ST. LOUIS 17, MO.

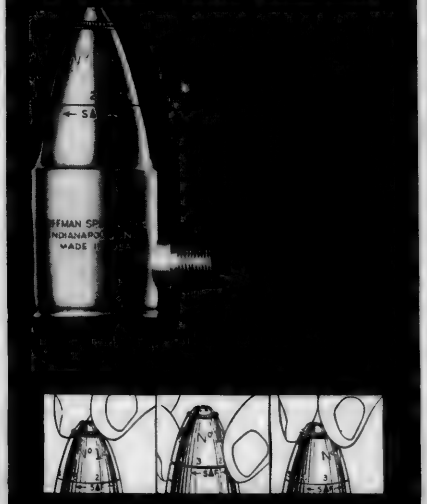
HOFFMAN VENTING VALVES

FOR EVERY STEAM and HOT WATER SYSTEM

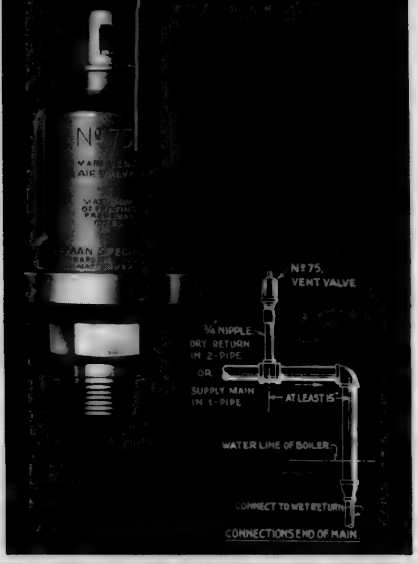
No. 500
UNIVERSAL AIR VENT



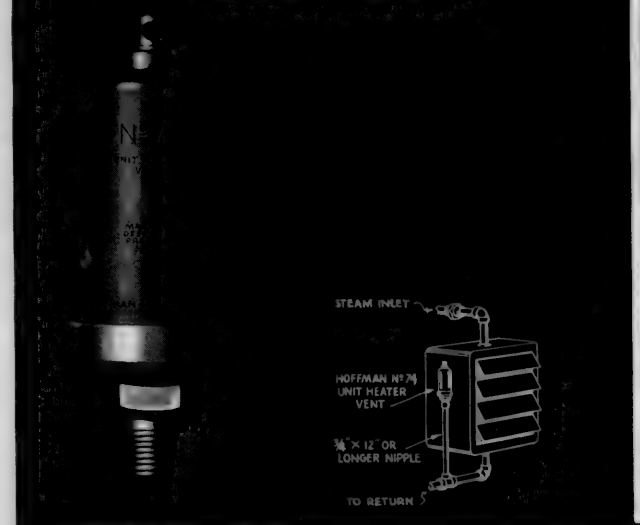
No. 1A BALANCER
WITH CHOICE OF 6 VENT PORTS
TO FIT EVERY VENTING REQUIREMENT



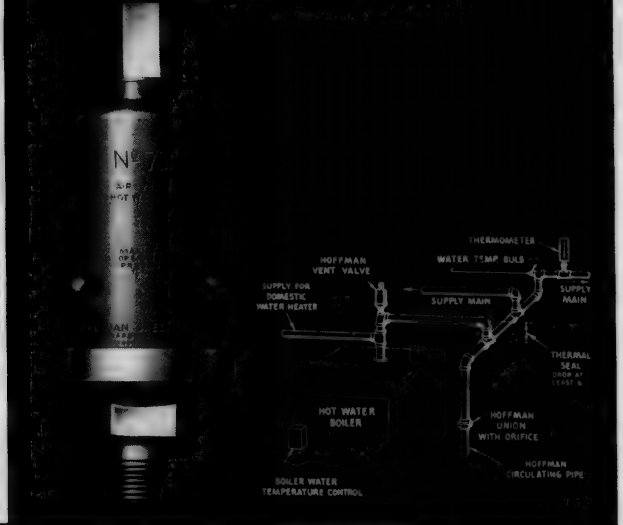
No. 75
MAIN VENT



No. 74
FOR UNIT HEATERS



No. 79
HOT WATER VENT



Have these valves in your stock for the early replacement jobs

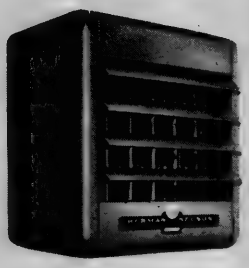
For either one-pipe or two-pipe steam, hot water, residential or industrial heating—Hoffman assures you the correct Vent Valve for each specific requirement. For the hard-to-balance radiators, the Hoffman line includes adjustable-port valves, available for vacuum and non-vacuum systems. It is not too early to order adequate stocks of Main and Radiator Vent Valves for modernizing jobs. Call your Wholesaler.

HOFFMAN SPECIALTY MFG. CORP. • **1001 York Street, Indianapolis 7, Indiana**

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps — Sold by Leading Wholesalers of Heating and Plumbing Equipment

Some like it wet

Recommend for them the Herman Nelson Horizontal Unit Heater, designed for either steam or hot water service. Made in 19 sizes . . . a complete range for every job. New Vertical Fin Assembly, working with horizontal louvers, spots or diffuses heat *anywhere* or *anyhow* you want it!



WRITE FOR CATALOG No. 700

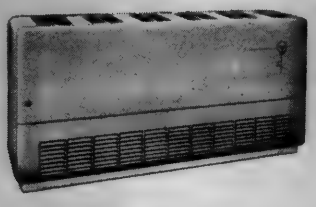
Some like it dry

For them, install the Herman Nelson Gas-Fired Unit Heater, available in 7 sizes—job-rated for stores, lobbies, studios, warehouses, offices, salesrooms—wherever *both* beauty and efficient heating are your requirements.

WRITE FOR CATALOG No. 715

Some like it on the floor

Offer those customers the handsome new Console Heater that solves heating problems in a wink . . . works quietly and efficiently year after year, utilizing steam or hot water. Twelve models in all—not only for floor installation, but also for wall, ceiling or recessed applications.

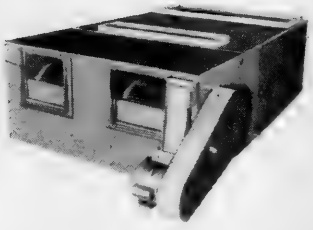


WRITE FOR CATALOG No. 725

Some like it high

This new Heating and Ventilating Unit may be hung from ceiling out of the way, or mounted on wall or floor. A quiet-operating, slow speed unit with completely rotatable fan section. Sectional type unit may be assembled many ways for all types of institutional and commercial installations.

Write for free descriptive literature . . . today!



WRITE FOR CATALOG No. 775

PLEASE 'EM ALL WITH JOB-RATED

HERMAN NELSON UNIT HEATERS

Choose From A Complete Range Of Models And Sizes

American Air Filter
COMPANY, INC.

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294 Central Avenue, Louisville 8, Ky. • American Air Filter of Canada, Ltd., Montreal, P. Q.

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PIPING SYSTEMS

Why EBKO Prefabricated Insulated Piping Systems should be selected for underground and overhead distribution of steam, condensate return, hot and chilled water.

EBKO is designed and constructed of quality materials having proven their stability and reliability for many, many years. The trial and error stage is long past.

Because EBKO has positively proven itself with years of actual physical experience, theoretical ideas play no part in its construction. EBKO Piping Systems are guaranteed for these reasons — Time Tested and Test Proven — the magic phrase to a successful installation with the highest performance characteristics obtainable.

EBKO assures satisfaction and security. EBKO has established a reference of successful installations throughout the country only by supplying the industry with a quality product with such features as permanency, maintenance free operation, and high efficiencies.

The insulated prefabricated piping system is only one of the many popular systems manufactured by EBKO.

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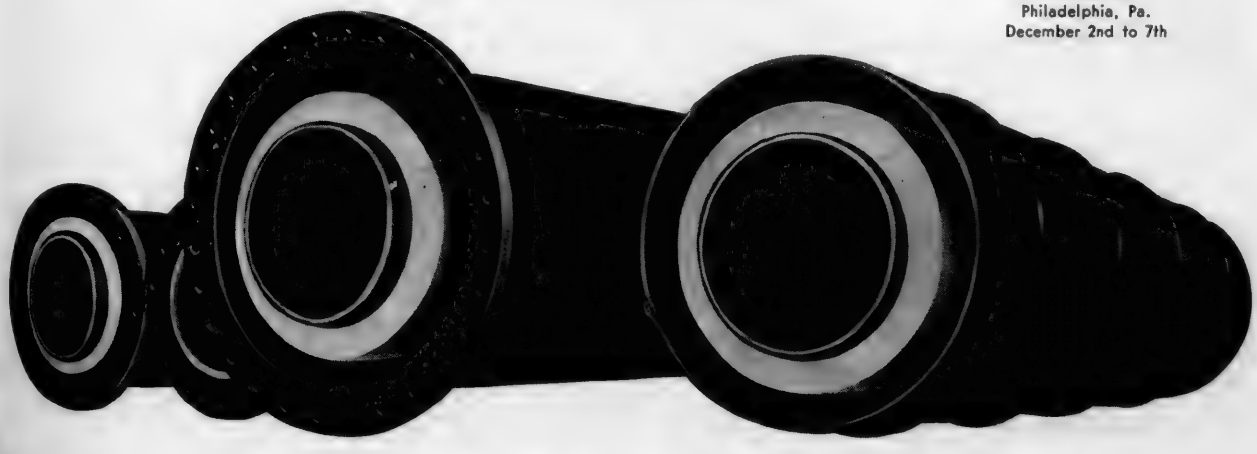


THE EXCLUSIVE

snap action

FEATURE ELIMINATES WIRE DRAWING

illinois STEAM TRAPS

SIMPLE—EFFICIENT—DEPENDABLE

The valve action of an Illinois trap is instantaneous. It is either wide open or tight shut. Wire drawing is impossible. The valve stem travels independently of the bucket—no other trap has this feature.

Here are some "reasons why" of Illinois' outstanding popularity:

SIMPLE—moving parts are valve and bucket only, all motion vertical...**CANNOT AIR-BIND**—continuous air venting through thermostatic air vent—no steam loss ...**CANNOT BLOW STEAM**—valve always water sealed...**NO LEAKAGE AT REDUCED PRESSURE—NO LEAKAGE AT REDUCED RATE OF FLOW**—at any point in the range...**NO CHATTERING DURING FLOOD CONDITION**...**SURFACE DISCHARGE**—flushes out all grease and sludge...**VALVE AND SEAT**—hardened steel alloy...**INSPECTION EASY**—without disturbing piping...**DRAINS CONDENSATE EQUALLY WELL**—from compressed air lines, air separators, air after-coolers, gas mains.

Sizes from ½ inch to 2 inches and pressures from 5 psi up to 250 psi. Extra heavy duty steel bodies for pressures up to 600 psi.

ILLINOIS ENGINEERING COMPANY

DIVISION OF AMERICAN AIR FILTER COMPANY, INC.

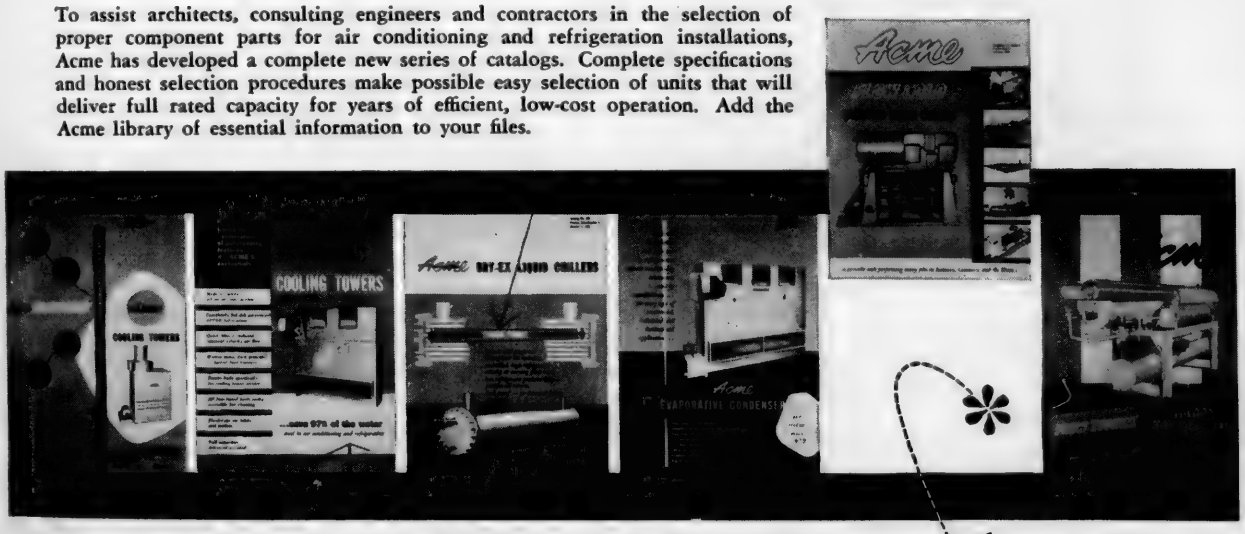
2045 SOUTH RACINE AVENUE • CHICAGO 8, ILLINOIS

the WHY *of* Acme LEADERSHIP *in air conditioning and refrigeration engineering*

Acme Industries, Inc., of Jackson, Michigan has been serving the Air Conditioning and Refrigeration industries since 1919. During that long span of years, Acme engineers have built a fount of knowledge and technical experience that enables them to design, build, and select products to fit any temperature control problem. Leading architects, engineers and refrigeration contractors have come to depend upon and insist upon Acme products in their installations. Long lists of satisfied Acme users line the ranks of American business and industry. You can look to Acme for superior performance in all phases of air conditioning and refrigeration.

the Acme *air conditioning and refrigeration library*

To assist architects, consulting engineers and contractors in the selection of proper component parts for air conditioning and refrigeration installations, Acme has developed a complete new series of catalogs. Complete specifications and honest selection procedures make possible easy selection of units that will deliver full rated capacity for years of efficient, low-cost operation. Add the Acme library of essential information to your files.



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JACKSON, MICHIGAN

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

- Evaporative Condensers
- Cooling Towers — 2 to 70 tons
- Blo-Cold Unit Coolers
- Dry-Ex (direct Expansion, Liquid Chillers
- Shell-and-Tube, Shell-and-Coil Condensers
- Flow-Cold packaged Liquid Chillers to 15 tons
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- Heat Exchangers
- Liquid Receivers
- Flow-Temp Heat Pumps
- Remote Room Conditioners
- Oil Separators

[ ] Acme Flow-Cold Cooling Towers, 2 to 15 tons
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[ ] Acme Dry-Ex (Direct Expansion) Liquid Chillers
[ ] Acme Evaporative Condensers
[ ] Acme Flow-Cold Packaged Liquid Chillers, 2 to 15 tons
[ ] Acme Flow-Therm Packaged Liquid Chillers to 220 tons

Name.....
Address.....
City.....Zone.....
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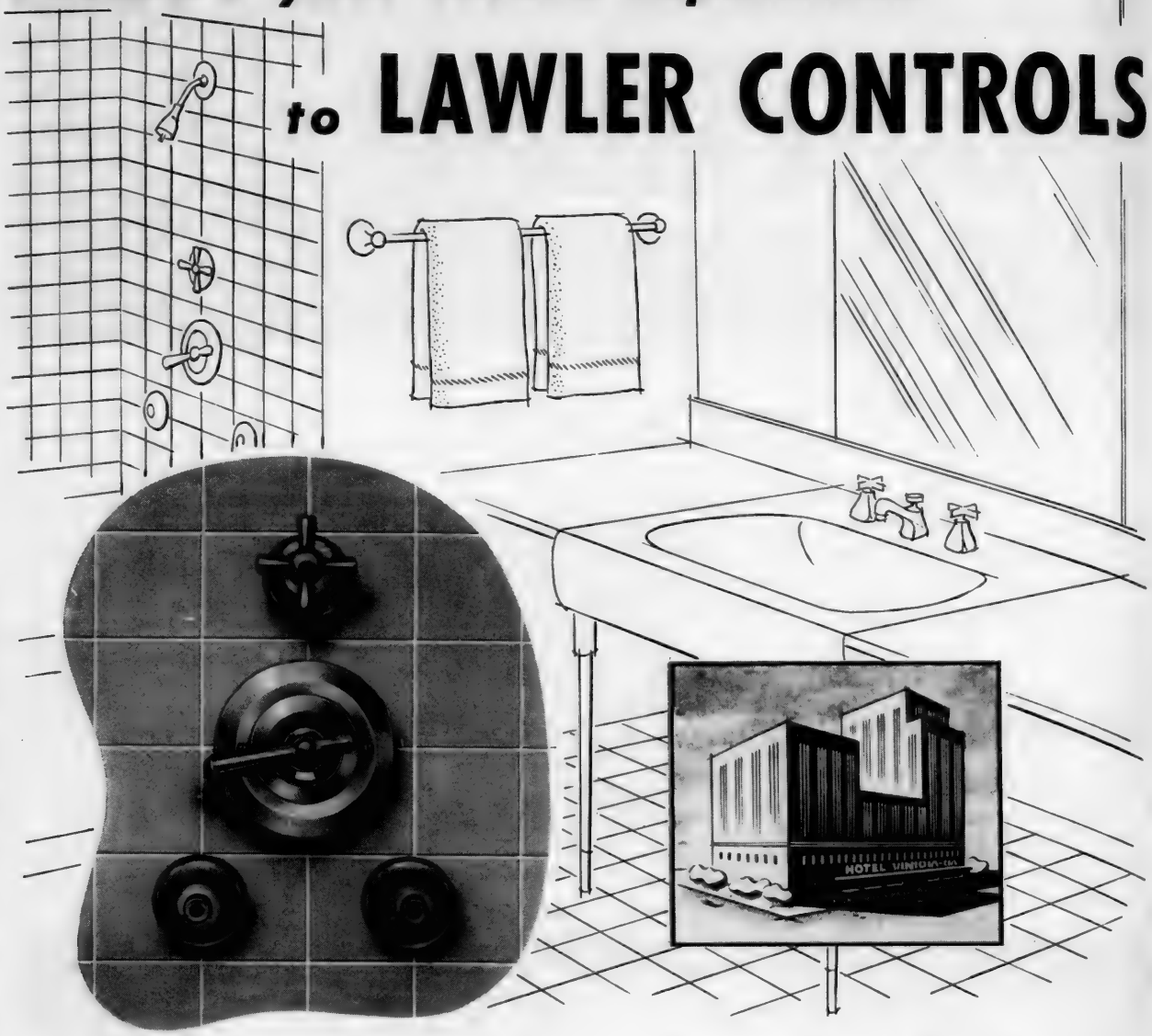
TRUST *your future reputation* to LAWLER CONTROLS

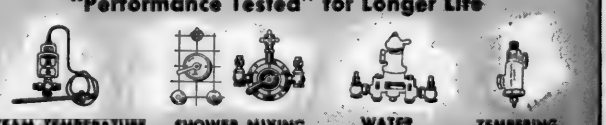


MODEL BC CONCEALED THERMOSTATIC SHOWER MIXING VALVE

Finished in polished chrome where exposed, has all sliding parts of stainless steel for corrosion proof operation. Actual tests show that it gives highest degree of control.

Lawler's "Performance-Tested" design combines pioneering experience with engineering leadership. The use of specially chosen metals assure YOUR customers years of positive, accurate temperature control with lowest maintenance cost . . . the best insurance YOUR REPUTATION can have.

"Performance Tested" for Longer Life



STEAM TEMPERATURE REGULATORS | SHOWER MIXING VALVES | WATER CONTROLLERS | TEMPERING VALVES

The Lawler Line **of Thermostatic Controls**

LAWLER AUTOMATIC CONTROLS, INC. 453 North MacQuesten Parkway, Mount Vernon, N. Y.

B&W TYPE FM BOILER SAVES $1000 A MONTH for

AMERICAN-LAFRANCE-FOAMITE Corporation

One of the world's largest manufacturers of fire-fighting equipment has reduced its fuel and operating costs at the rate of $12,000 per year by installing a B&W Integral-Furnace, Type FM, and making other related plant improvements. It is estimated that in 6 years this B&W steam generator will pay for itself.

Tied in with the plant's existing high-pressure steam system, it will produce 8,000 lb of steam per hour in heavy-load periods and will operate alone to furnish power for low-load periods. The biggest single saving effected by this installation is fuel. Formerly a large portion of the fuel burned during the summer, averaging about 50 tons per week, was used for banking and actually served no useful purpose. The automatic oil or gas-firing feature of the FM Boiler eliminates banking. Further, the unit's compact design and completely automatic features, including the flame-failure detection device, releases operating and maintenance personnel for other duties.

The completely shop assembled, FM Boiler is virtually on the line upon arrival—needing only hooking up of service connections before it goes to work. This widely-used B&W unit is suitable for a wide range of industrial, commercial, institutional, and other classifications. It is available in standard sizes for loads ranging to 36000 lb of steam per hour, at pressures to 235 psi. It is available for higher pressures. FM units in service, and on order represent a steam output of over 9,000,000 lb per hour and considerable savings in fuel and operating costs that are well worth serious consideration.

COST-SAVING FEATURES of the B&W Type FM Boiler

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

BABCOCK & WILCOX

BOILER DIVISION G-638

How to Select an Economical Temperature Regulator

First of all, what does economy mean where temperature regulators are concerned? In some industries it means improvement of product or reduction of spoilage through closer control of process temperatures. In others, it means the paring down of operating expense. The price of the regulator itself is a relatively small factor.

Today's buyers are shopping for:

1. Accuracy of control — not only when the regulator is new, but throughout its service life
2. Dependability — to prevent loss of production time
3. Minimum installation and maintenance cost

Here are a few tips on what to look for when you're installing a new or replacing an old temperature regulator —

Packless construction . . . and for this reason: A diaphragm operated, packless regulator minimizes friction. There are no closely fitted parts to stick or bind because of uneven expansion or collection of foreign matter. Also, there's less maintenance, since no repacking is ever required.

A guarantee against wire drawing of the seats and discs. Insist on it. This guarantee in combination with single seat design assures you of tight shutoff; you avoid expensive steam losses as well as loss of product in a process application.

Broad control range. In a standard regulator you should expect a control range of 100 F. And make sure the unit you select has a vapor tension thermostat that can take over-temperatures of at least 100 F.

Easy maintenance. Why ask for grief? Your temperature regulator should be basically simple in design so that it can be serviced by average plant personnel. All parts should be readily accessible for testing and cleaning.

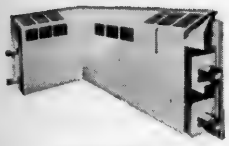
Double duty. There's no point in buying a separate pressure regulator when you can select a temperature regulator that combines both temperature and pressure control within the same unit.

Self-operating. Make sure you get a regulator that operates on its own initial pressure. By doing so, you avoid the purchasing and maintenance of an air compressor plus air piping, and you're sure of uninterrupted operation during electric power failures.

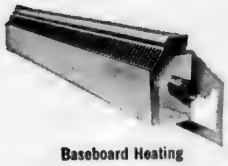
• • • •

All of these points are important to you when it comes to selecting an economical temperature regulator. Perhaps you didn't realize you *could* expect so much. And perhaps you didn't realize that Spence Temperature Regulators offer all these features and more. May we send you our Bulletin T 500 containing further details? SE 130

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

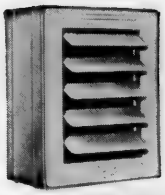


Wall Radiation

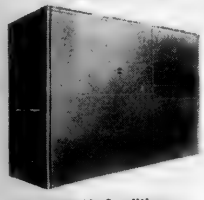


Baseboard Heating

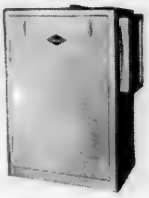
Down Blow Unit Heaters



Horizontal Unit Heaters



Model AEC Air Conditioners with self-contained water saver



Furnace Air Conditioners

Highboy Air Conditioners

Mobile Air Conditioners

UNARCO Convector-Radiator

- Snap-on front panel • easy-to-clean • Knock-out end panels for easy installation • Cast bronze headers for added heat transmission
- 18-gauge steel front and top • Directional die-formed louvers
- Simple damper control • Carefully rounded corners for safety
- Attractive modern design
- Ideal for homes, offices, institutions, industrial and commercial uses

year 'round weather conditioning*

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World's finest heating and cooling products in a complete range of types and sizes

- Priced to sell
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- ☐ Baseboard Heating
- ☐ Wall Radiation
- ☐ Horizontal Unit Heaters
- ☐ Down Blow Unit Heaters
- ☐ Highboy Air Conditioners
- ☐ Furnace Air Conditioners
- ☐ Mobile Air Conditioners
- ☐ Model AEC Air Conditioners with self-contained water saver

Please have representative call ☐

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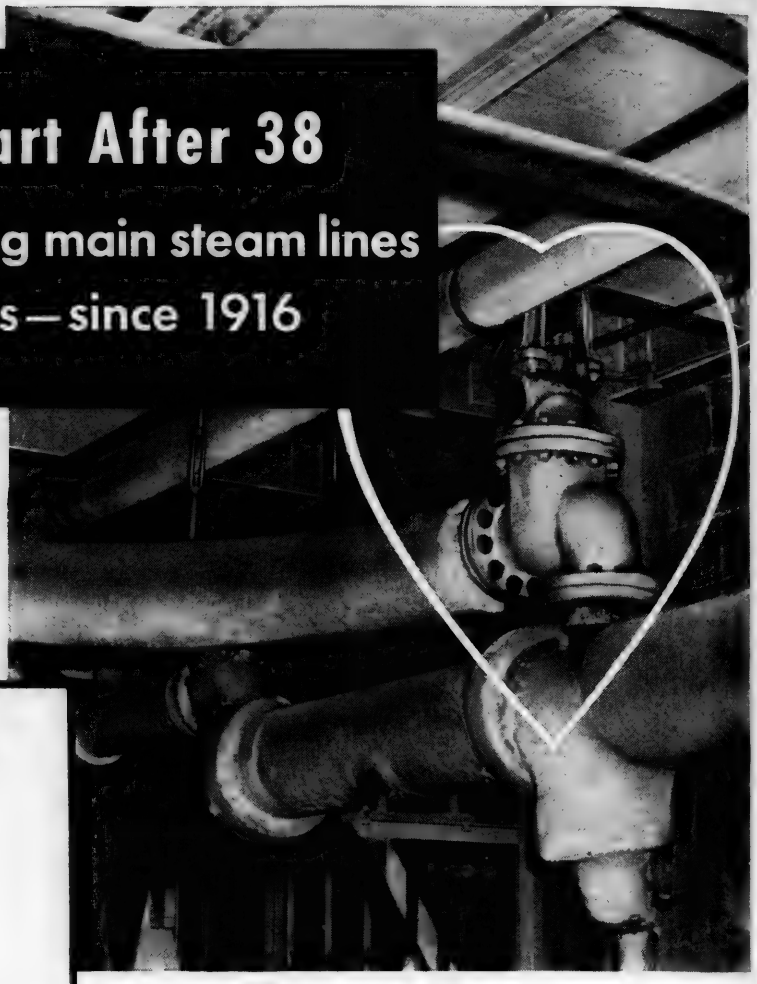
Young at Heart After 38

Crane valves policing main steam lines with no repairs—since 1916



The Installation

In the Lehigh Portland Cement Co. plant at Oglesby, Ill. Original installation of 6- and 3-inch Crane steel valves in boiler-to-turbine steam piping. Working pressure: 160 pounds at about 475 deg. F.

Valve Service Ratings

SUITABILITY:
Hard to Beat

MAINTENANCE COST:
Not a penny for repairs

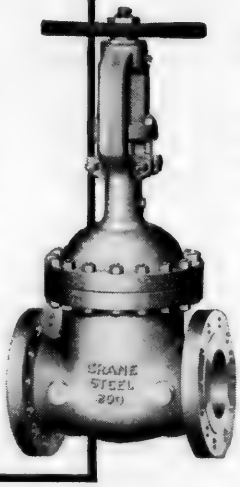
SERVICE LIFE:
38 yr.—still O. K.

OPERATING RESULTS:
Lowest cost steam control

AVAILABILITY:
Complete Crane line of modern patterns

The Valve

Like their 1916 counterpart designs, modern Crane Steel Valves give you performance that wins preference in every industry. They give you the values of steady leadership in steel casting . . . quality design . . . precise manufacturing. And the range of the Crane line in pressure classes, materials, and patterns, meets every need. See your No. 53 catalog, or your Crane Representative.



The Case History

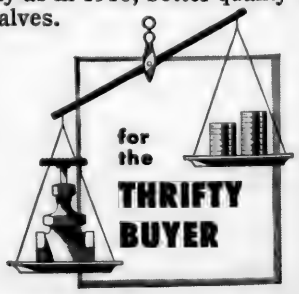
Never, since installed in 1916, have these Crane valves been out of service for repairs. Only care given—and good care, obviously—is prompt repacking of the stuffing box and lubrication when needed. Such attention usually includes a general clean-up.

Neither infrequent operation nor the non-lubricating properties of steam have troubled these valves. They respond to the handwheel with smooth, positive action. High wear-resistance in seating materials keeps them tight as new, year after year.

Buying quality valves from the start assured this amazingly low-cost main line steam control. Today this buying policy is more justifiable than ever. And today as in 1916, better quality valves mean Crane valves.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

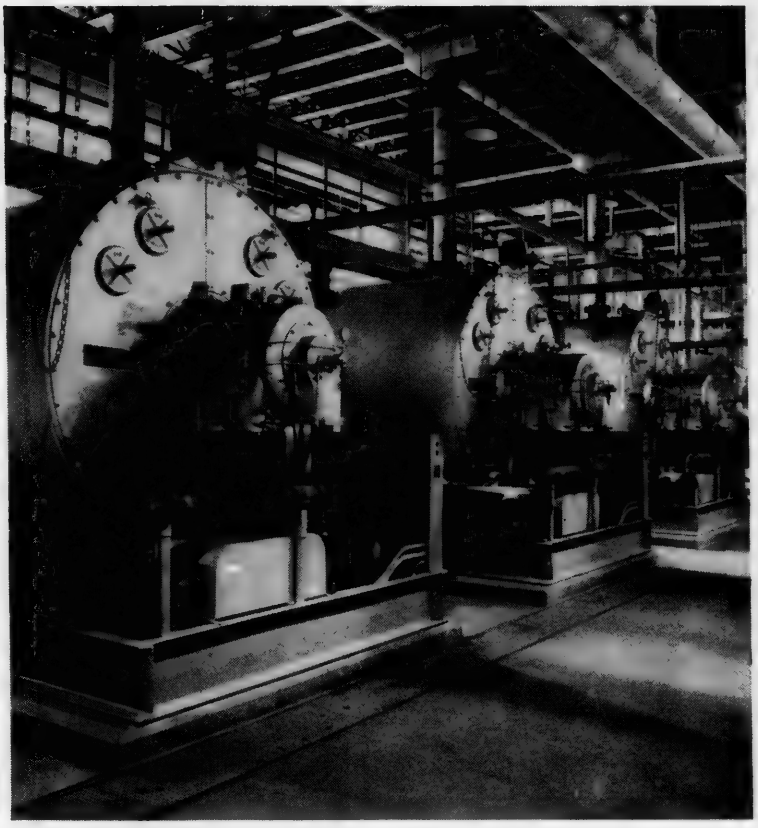
CRANE VALVES



CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

IN HOSPITALS...



Modern *Powermasters*® Save in Many Ways!

FOR EXAMPLE: The new 240-bed Druid City Hospital, Tuscaloosa, Alabama, designed its steam system with three 300 HP gas-fired *Powermaster* Packaged Automatic Boilers. Light oil is provided as stand-by fuel.

Powermaster savings start with simplified installation. No special foundation or costly stack is needed. As delivered, *Powermasters* are factory-assembled and fire tested, fully equipped and wired ready for operation as soon as fuel, water, electrical and steam connections are made. Other savings are high fuel economy at all loads, compactness, maintenance-saving accessibility, dependable performance, time-saving attention, fully automatic operating and safety controls, smokeless combustion and hospital-clean operation.

Prove for yourself that steam costs do go down where *Powermasters* go in. Compare *Powermaster,* feature by feature, and see why it is preferred by modern hospitals all over the world.

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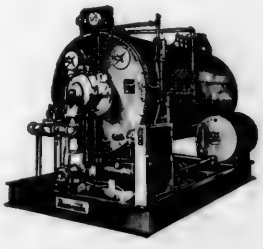
Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.



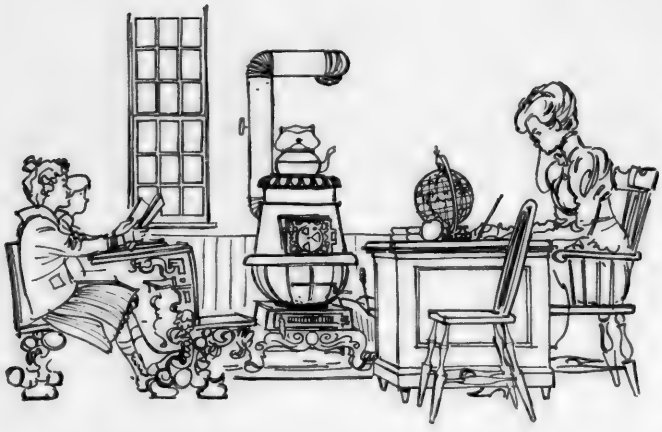
ORR & SEMBOWER, INC. Morgantown Road, Reading, Penna.

Congratulations to Macon, Georgia on its radiant heated Junior High School for Girls

The little Red Schoolhouse

Albany, Georgia keeps pace with radiant heated Isabella Heights School

...aint what she used to be!



Memories of the little red schoolhouse and the heart-tugging refrain "school days, school days, good old golden rule days" are fine . . . sentimentally. Practically, we Americans have too much concern for the health and welfare of our children to really want to return to the era of the wood stove and kerosene lamp. The hickory stick . . . maybe . . . but not the others!

We take pride in the finest school buildings in the world because we know that the education of our children is the most *important* thing in the world . . . basic to American progress. So we're not "soft," just realistic, in providing the best light, heat, sanitation and recreational facilities possible. Healthy children learn more, faster.

All over the country new schools are incorporating radiant heating because its gentle, all-permeating, sun-like warmth . . . without hot or cold spots, drafts, or dust laden currents . . . provides the most healthful school heating known. Concealed heat sources and controls resist vandalism, promote safety, save valuable floor and wall space and improve classroom appearance. Auditoriums and gymnasiums (even swimming pools!) derive particular benefit.

Steel pipe is, of course, first choice for radiant heating as it is for conventional heating . . . proved in more than 60 years of service in steam and hot water systems. In fact steel pipe is the most widely used pipe in the world, for heating, plumbing, snow melting, fire sprinkler systems and the transmission of power, steam and air.

Beautiful Lakeview School, Vass, N. Carolina will be comfortable, too, with radiant heating

Typical installation in modern schoolroom

Washington - Douglass Elementary School, Jackson, Tenn., looks as modern as its radiant heating

Send for free 48 page color booklet "Radiant Panel Heating with Steel Pipe" and 32 page companion booklet "Steel Pipe Snow Melting and Ice Removal Systems."

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 FIFTH AVENUE, NEW YORK 1, N. Y.

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HAVE DESIGNS ON SPACE

Floor to floor height can be kept to a *minimum* and usable floor space to a *maximum* with Anemostat High Velocity Air Conditioning. • HV units, used with smaller than conventional ducts, save space, and money too. They substantially reduce pounds of sheet metal required, can be installed faster, with less labor. • HV Manual 48 contains specification data on 7 types of Anemostat High Velocity units, for all engineering and architectural requirements. Write for free copy.

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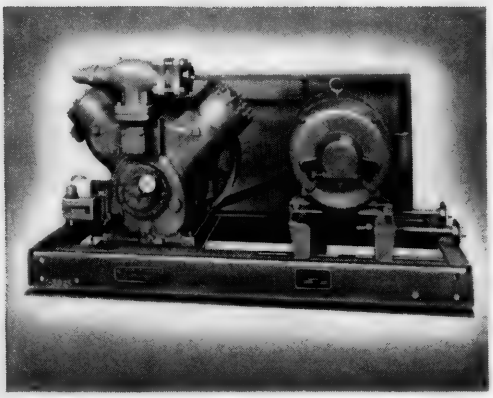
REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

THE STERLING, MIAMI BEACH'S NEWEST waterfront hotel, enjoyed a banner first season last winter. Owner David Rosner assigns a good share of the credit to his Worthington-engineered air conditioning system which cools the 142 rooms and 186,000 cubic feet of dining and lobby space. "Maintenance service (routine checkups) couldn't be better," says Manager Sam Rosner, with an eye on the potential business losses (running into thousands of dollars) that might follow mechanical breakdown. System includes both central and packaged air conditioners.

Worthington teams central and packaged air conditioners to cool new Miami Beach hotel

7½-TON, 3-TON, AND 1½-TON PACKAGED AIR CONDITIONERS with the famed Freon compressor like this serve as booster units to keep Sterling's crowded bar, television and card rooms cool without over-cooling other areas. Write for facts to Worthington Corporation, Air Conditioning and Refrigeration Div., Section A.4.50, Harrison, N.J.



BASIC AIR CONDITIONING UNIT for the Sterling Hotel is this 60-ton Worthington Freon compressor, end product of a million-dollar research program. Worthington equipment includes two Freon compressor units, three packaged air conditioners, and one shell and tube condenser. And Worthington's special cut-off system keeps power costs low when only minimum temperature changes are required. A.4.50

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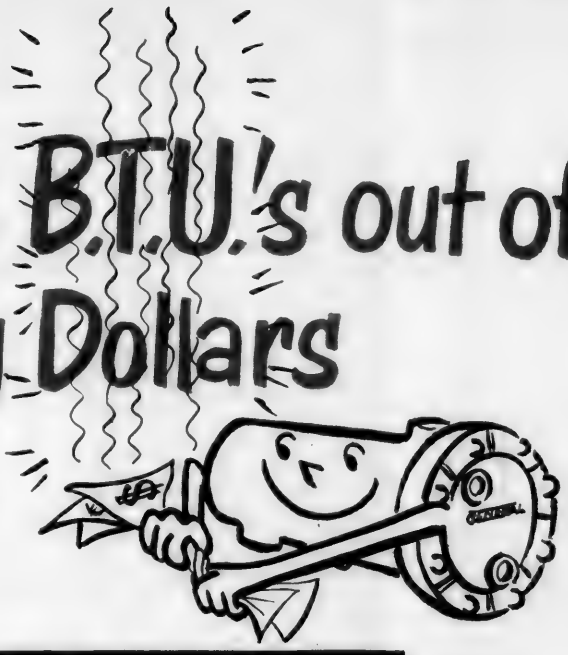
Climate Engineers to Industry, Business and the Home

This specialized line

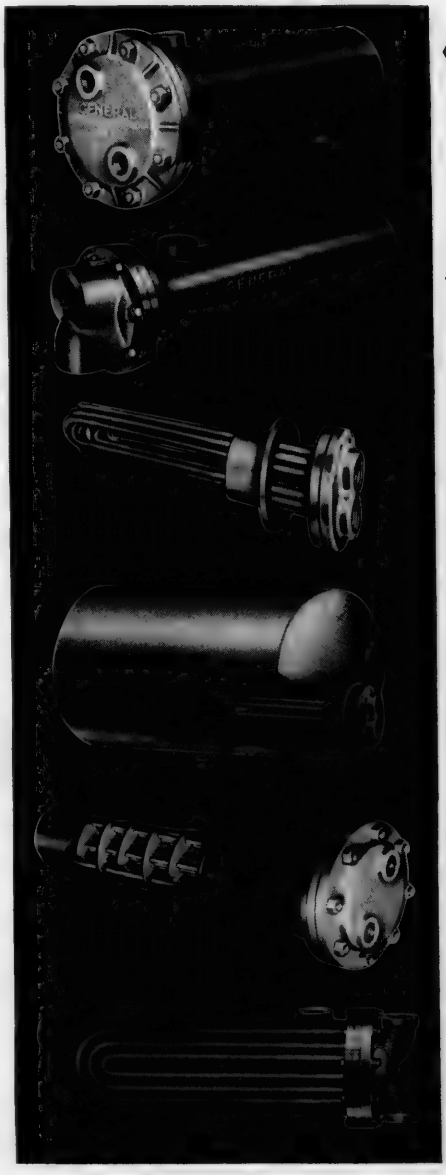
Squeezes more B.T.U.'s out of Fluid-heating Dollars



Whether the heat source for your next installation is hot water, exhaust steam, or live steam, you'll find a GENERAL Industrial Fluid Heater specifically designed to get the most heat out of it.

Every GENERAL heater is backed by 25 years experience in the manufacture of industrial fluid-heating equipment. It's the end-product of constant modification and improvement . . . "tops" for its particular application.

No matter what job you're planning — new construction, expansion, modernization — this up-to-date line is your best bet . . . for better performance, longer service, lower cost. Write for Catalog 60. General Fittings Company, Dept. L, 123 Georgia Ave., Providence 5, R. I.



INSTANTANEOUS WATER HEATERS No tank required. 23 sizes; capacities to 300 g.p.m.; uses live or exhaust steam.

CONVERTERS 74 sizes for economical heat transfer. Flow capacities up to 900 g.p.m.

TANK HEATING UNITS 20 sizes for all requirements.

STORAGE TANKS 10 sizes; capacities to 315 gals.

FUEL OIL HEATERS 17 sizes; capacities to 375 g.p.h. at 2 lbs. pressure.

INDIRECT HEATERS 15 sizes for use with large-size storage tanks.

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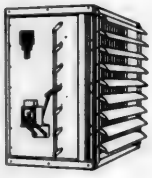
TANKLESS AND INDIRECT WATER HEATERS AND HEATING SPECIALTIES

Is this the way your plant gets its MAKE-UP AIR ?

IF SO, YOU NEED

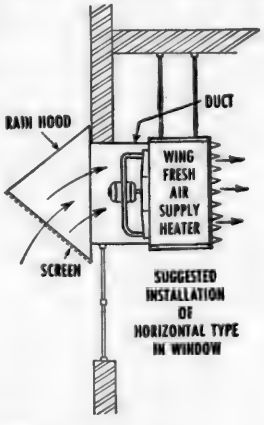
WING FRESH AIR SUPPLY HEATERS

WHEN air is exhausted from paint spray booths or other plant operations, it must be replaced. If no other means are employed, it rushes back through opened doors or windows, or seeps back through cracks and crevices. Your exhaust fans can't work properly or efficiently and your heating system is nullified. WING FRESH AIR SUPPLY HEATERS are the answer. They supply make-up air properly heated, they require no expensive duct work and the coils cannot freeze, regardless of weather, because full steam pressure is on at all times.



HORIZONTAL TYPE WING FRESH AIR SUPPLY HEATER

Write for complete information



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L. J. Wing Mfg. Co.

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Factories at Linden, N.J. & Montreal, Can.
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OUR 75TH YEAR

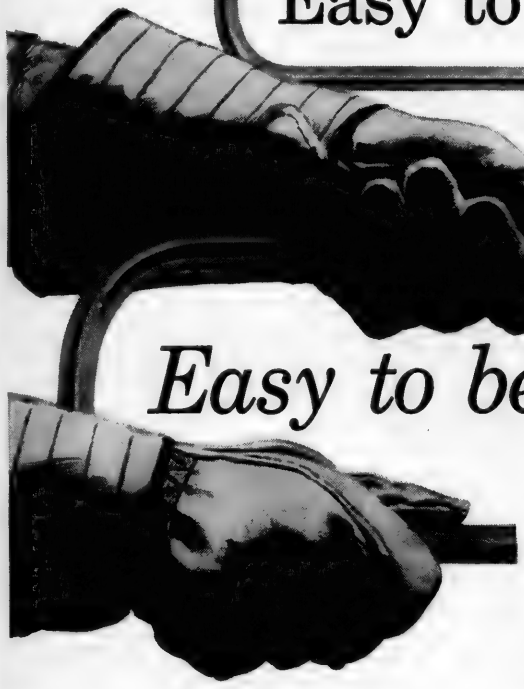
Wing

SEVENTY-FIVE YEARS AGO

Demonstrating the new Edison phonograph. This simple hand-cranked machine, invented in 1877, was soon to be in every home, doing for sound what the invention of printing had done for literature. In 1879, L. J. Wing, another talented inventor of that period, was designing and building fans, steam engines and electric motors, which won many awards for the L. J. Wing Mfg. Co., today celebrating its 75th anniversary.

Easy to bend

Easy to bend



Easy to bend by hand

Chase Copper Tube makes radiant heating jobs easy for you...better for your customers. It's *soft* temper for easy bending...*light* for easy handling...and it comes in long lengths—so fewer joints are needed. Combined with Chase Solder-Joint Fittings, it makes a leak-proof, pressure-tight, *quality* system that's corrosion-resistant and can't clog with rust—*ever.* Order from your Chase wholesaler.

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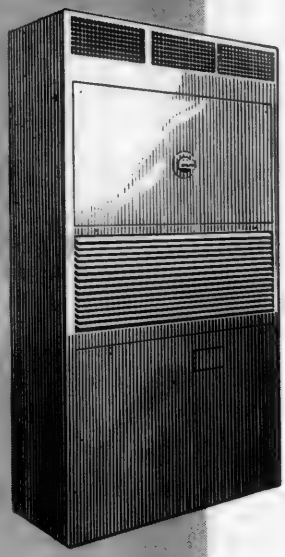
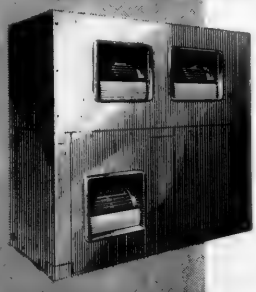
There's money in the air...
when you sell **CHRYSLER AIRTEMP!**

"Packaged" Water-Cooled Air Conditioners in 6 models, from 2 to 15 H.P.



"Packaged" Waterless Air Conditioners—no water needed, no plumbing required. 2, 3, 5 and 7½ H.P.



are you prepared to sell any job?

HERE'S EVERYTHING YOU NEED!

You can meet all the requirements of *any* job—when you sell Chrysler Airtemp "Packaged" Air Conditioning! It's the *complete* line with 6 water-cooled and 4 waterless models. The air-cooled, waterless models have been proved in thousands of installations. And only Chrysler Airtemp has 5 and 7½ H.P. air-cooled, waterless models.

There are other ways, too, in which the Chrysler Airtemp Franchise can give you competitive advantages that will pay off in more sales of "Packaged" air conditioning. Write today for complete details. Airtemp Division, Chrysler Corporation, Dayton 1, Ohio.

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Air Conditioning's other name... *Chrysler Airtemp*

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SPECIFY

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and get

PEAK PERFORMANCE

on all Flooded Systems

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LEVEL MASTER CONTROL

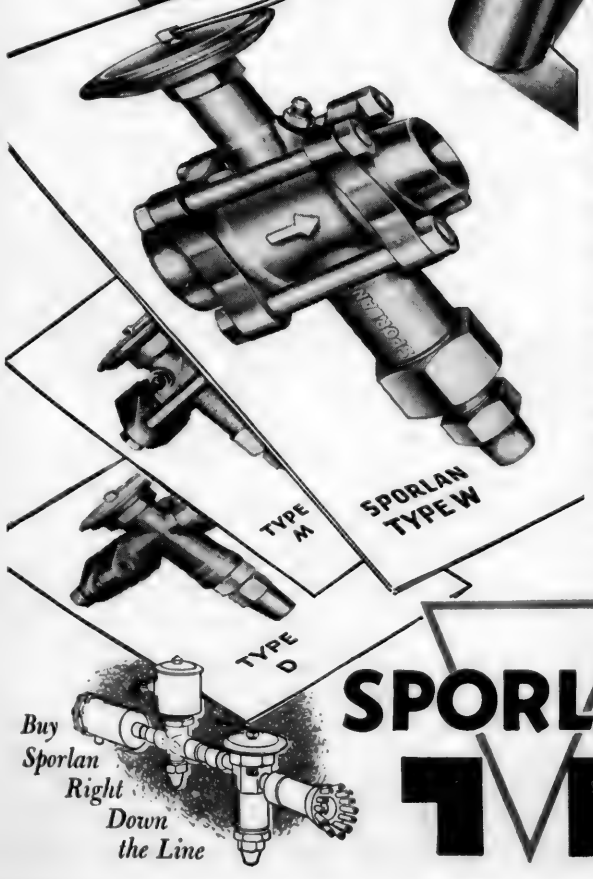
Again Sporlan offers you a NEW FIRST!...

A Positive Liquid Level Control for Ammonia, Freon-12, and Freon-22 with all these features!

First, the Sporlan LMC consists of a standard Sporlan Thermostatic Expansion Valve equipped with a matched Sporlan Level Master Element. That means that the liquid level control and the expansion device are combined into one unit, and you have a choice of Sporlan Thermostatic Expansion Valves for Freon-12 and Ammonia up to 100 tons, and for Freon-22 up to 180 tons... *thus no job is too large or small for the Sporlan* **LMC.** *Existing flooded systems can be easily and economically modernized and made automatic with the Sporlan* **LMC.** *The Sporlan* **LMC** *provides a* MODULATED FLOW *and maintains practically a static liquid level in the low side! The Sporlan* **LMC** *insert bulb has* NO MOVING PARTS!

Any two wire power supply of 115 or 230 volts, any frequency AC or DC, is adequate. The Sporlan LMC insert bulb can be installed in either a horizontal, vertical or angle position for direct contact with the refrigerant. If the liquid level drops, a heater element in the bulb acts as an artificial superheat increasing the pressure in the thermostatic element, thereby opening the valve. If the liquid level rises, its refrigerating effect on the bulb overcomes the heater, and the valve throttles.

The Sporlan **LMC** *is* NOT *affected by turbulance... tight closing* IS *assured... there is no current flow through refrigerant... and only proven thermostatic expansion valve performance is employed!*



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THEN SPECIFY SPORLAN LMC FOR ALL YOUR FLOODED JOBS!

Buy Sporlan Right Down the Line

SPORLAN VALVE COMPANY

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FOR MULTI-BLADE DAMPERS (PARALLEL OR OPPOSED)

Licensed by

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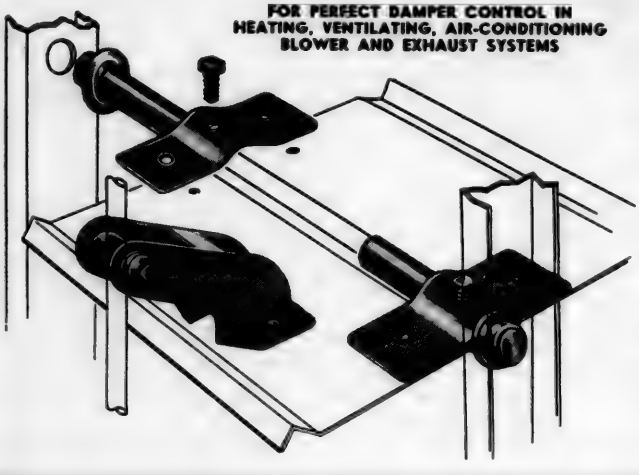

FOR PERFECT DAMPER CONTROL IN HEATING, VENTILATING, AIR-CONDITIONING BLOWER AND EXHAUST SYSTEMS

- ★ *Simple to assemble*
- ★ *Precision Machined*
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- ★ *Easily adjustable*

Set it ... Forget it!

Packed in Single Boxes or Bulk 100s

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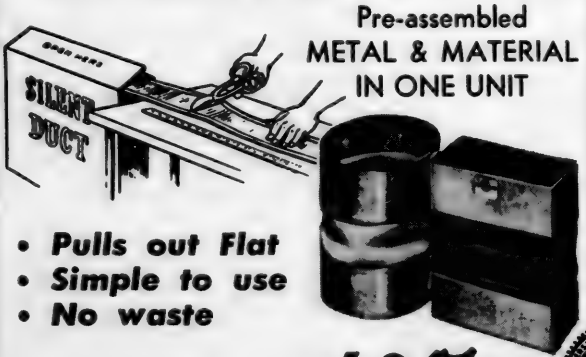
The Modern Flexible Connection



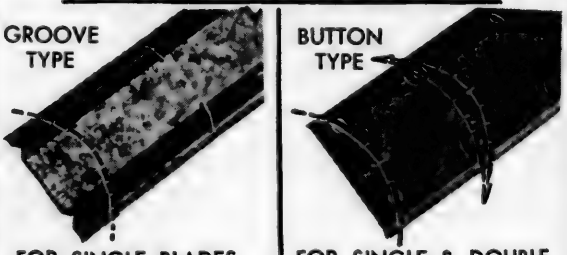
Pre-assembled
METAL & MATERIAL
IN ONE UNIT

- *Pulls out Flat*
- *Simple to use*
- *No waste*

SAVES up to 60% on PRODUCTION COSTS

UNION MADE
Patents Pend.

ELGEN *ALL-TITE* VANE RUNNERS



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BUTTON TYPE — FOR SINGLE & DOUBLE BLADES

The Quickest and Easiest Method for Making Turning Vanes in Square Elbows

NO SPECIAL CHISELS OR TOOLS REQUIRED

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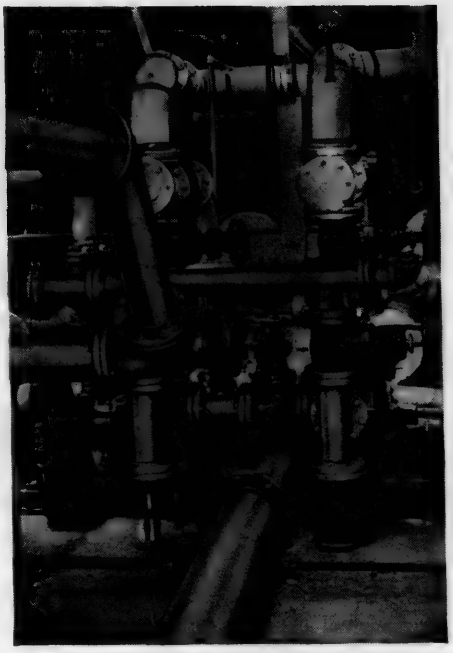

Quick Quiz

on copper piping

Q **A** **Isn't copper tubing more expensive to use than piping made of other materials?**

In some cases, yes. In most cases, no. There are many conditions under which ANACONDA Copper Tube proves to be the *least* costly piping obtainable. Prevention of rust, corrosion and contamination, together with the lower labor costs of installing solder-type fittings, often more than offset differences in piping material cost.

Q **A** **Why is copper tube easier to install?**

There are many reasons. First, ANACONDA Copper Tube is light, easy to handle. Second, it comes in longer lengths, which saves cutting and fitting. Third, it is more flexible, can be bent on the job—again saving cutting and fitting. Fourth, required connections are fast and easy to make. No threading.

Q **A** **Are changes in piping systems hard to make where copper tubing is used?**

Definitely no. Once installed, copper tubes connected with solder fittings can be taken down, moved, or have new connections cut in faster and with less expense than with threaded pipe.

Q **A** **Where can I get more facts?**

A well illustrated booklet, "ANACONDA Copper Tubes for Industrial Applications," is available on request. It contains a wide range of information on copper tubes, their applications, advantages and installation. Numerous reference tables useful to user and installer are also included. For a copy of this booklet, ask for Publication C-24 and send your request to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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COPPER TUBES

"...business helps itself by promoting thrift among its own people."

EDWARD C. BALTZ
President
Perpetual Building Association
Washington, D. C.

"Expanding the regular sales of U. S. Savings Bonds is essential to the continued success of our Government's sound money policy. Savings Bonds help people build security for themselves and stability for the nation's economy. A reserve in Bonds gives them the assurance to spend current income on homes, cars and other substantial purchases. Meanwhile, regular Bond buying goes on adding to their future buying power. Thus business helps itself by promoting thrift among its own people. The surest way to encourage an employee to save regularly right where he works is to sign him up on the Payroll Savings Plan."

Let's point up this statement by Mr. Baltz, head of one of the nation's outstanding thrift institutions and volunteer chairman of the District of Columbia Savings Bond Committee, with a few facts and figures:

- currently, more than 45,000 companies, large and small, representing every classification of industry and business, are encouraging national thrift through the Payroll Savings Plan.
- every month, 8,500,000 Payroll Savers in these 45,000 companies invest more than $160,000,000 in Savings Bonds.
- largely as the result of employer-encouraged thrift the cash value of Savings Bonds held by individuals on July 31, 1954, totaled more than 37.5 billion dollars.
- never before has America had such a reserve of future purchasing power.
- invested in America, these 37.5 billion dollars in Savings Bonds Dollars are a most effective check on inflation and a very important contribution to economic stability and a sound dollar.

A million new Payroll Savers by the end of 1954! That's the goal of those who believe that what is good for Americans is good for business. To do your part in reaching this objective, phone, wire or write today to Savings Bonds Division, U. S. Treasury Department, Washington, D. C. Your State Director, U. S. Treasury Department, will show you how easy it is to build a successful Payroll Savings Plan.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

HEATING & VENTILATING

New TEMTRIM Finned Pipe Radiation by American-Standard for Public, Industrial and Commercial Buildings

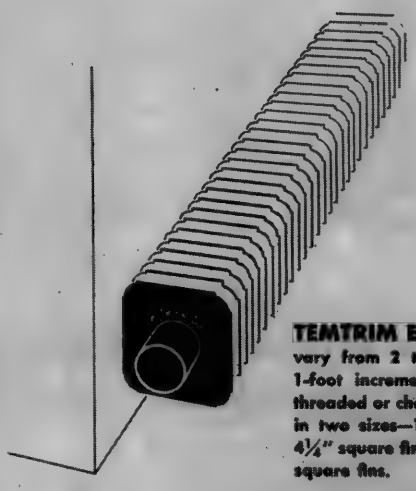
- ***Low cost***
- ***High heat output***
- ***Easy installation***
- ***Compact size***

● TEMTRIM is a welded steel pipe that bristles with steel radiating fins. It has a big, high-output heating surface, yet it is compact. Mounted on the wall, Temtrim projects only between 3 to 5 inches into the room.

TEMTRIM is economical to buy and install. Lengths of Temtrim can be connected and hung on wall brackets in a matter of minutes. Can be used with either hot water or steam systems for any type installation.

TEMTRIM can be installed with fins exposed, or with one of three attractive covers: expanded metal, louvered flat top or sloping louvered top. These sturdy steel covers are bonderized and finished with a gray prime coat.

With the addition of Temtrim, American-Standard offers a complete line of radiation for commercial and residential application. Included in the line are ferrous and non-ferrous baseboard panels and convectors and cast iron radiators, as well as remote type heating-cooling units. For information about Temtrim, mail coupon to **American Radiator & Standard Sanitary Corp.**, Dept. HV-114, Pittsburgh 30, Pa.



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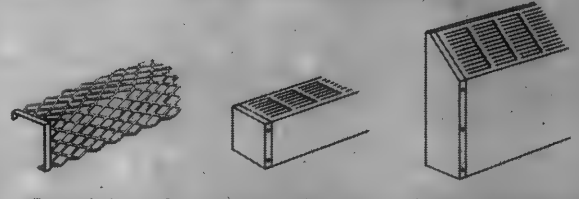
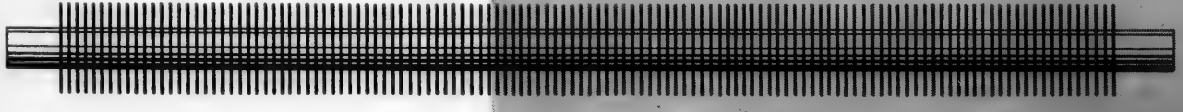


Expanded Metal — Louvered Flat Top — Sloping Louvered Top



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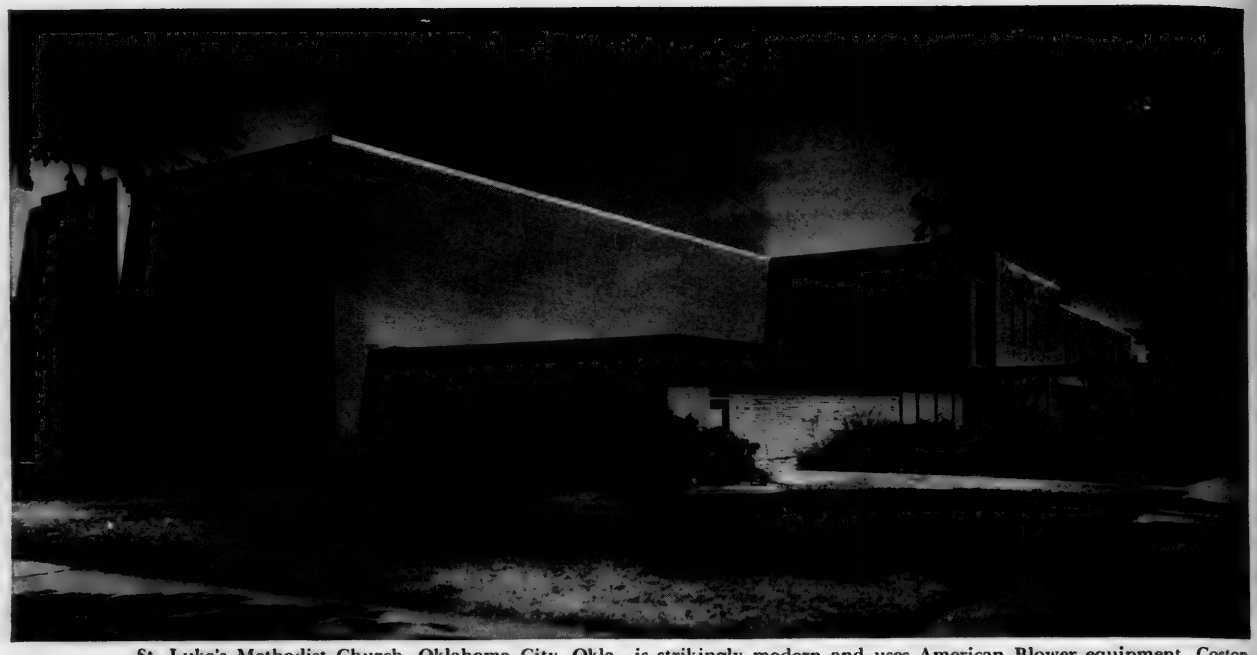

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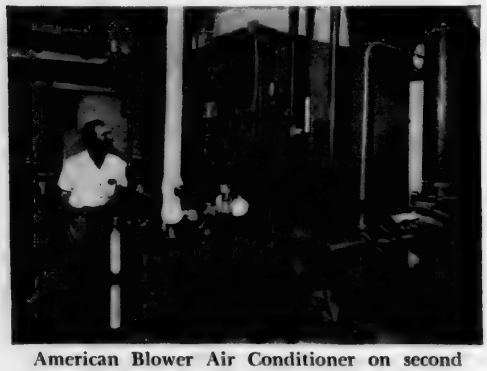

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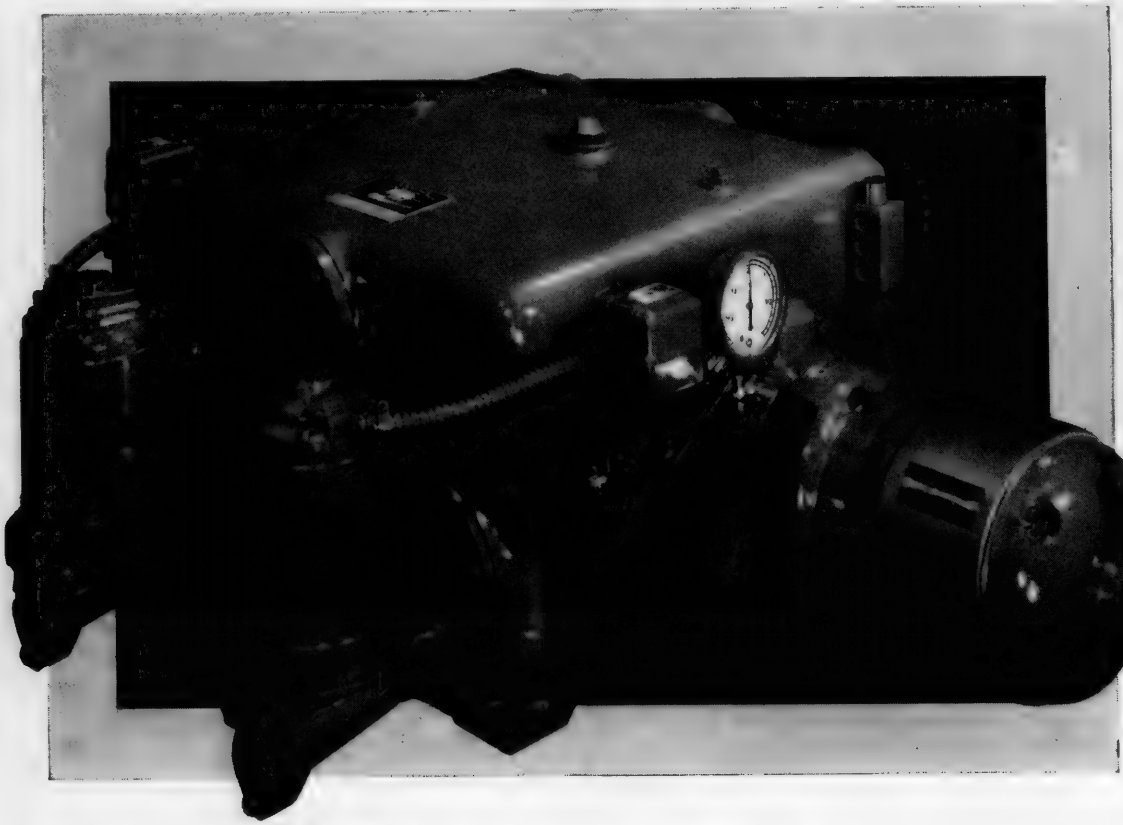

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These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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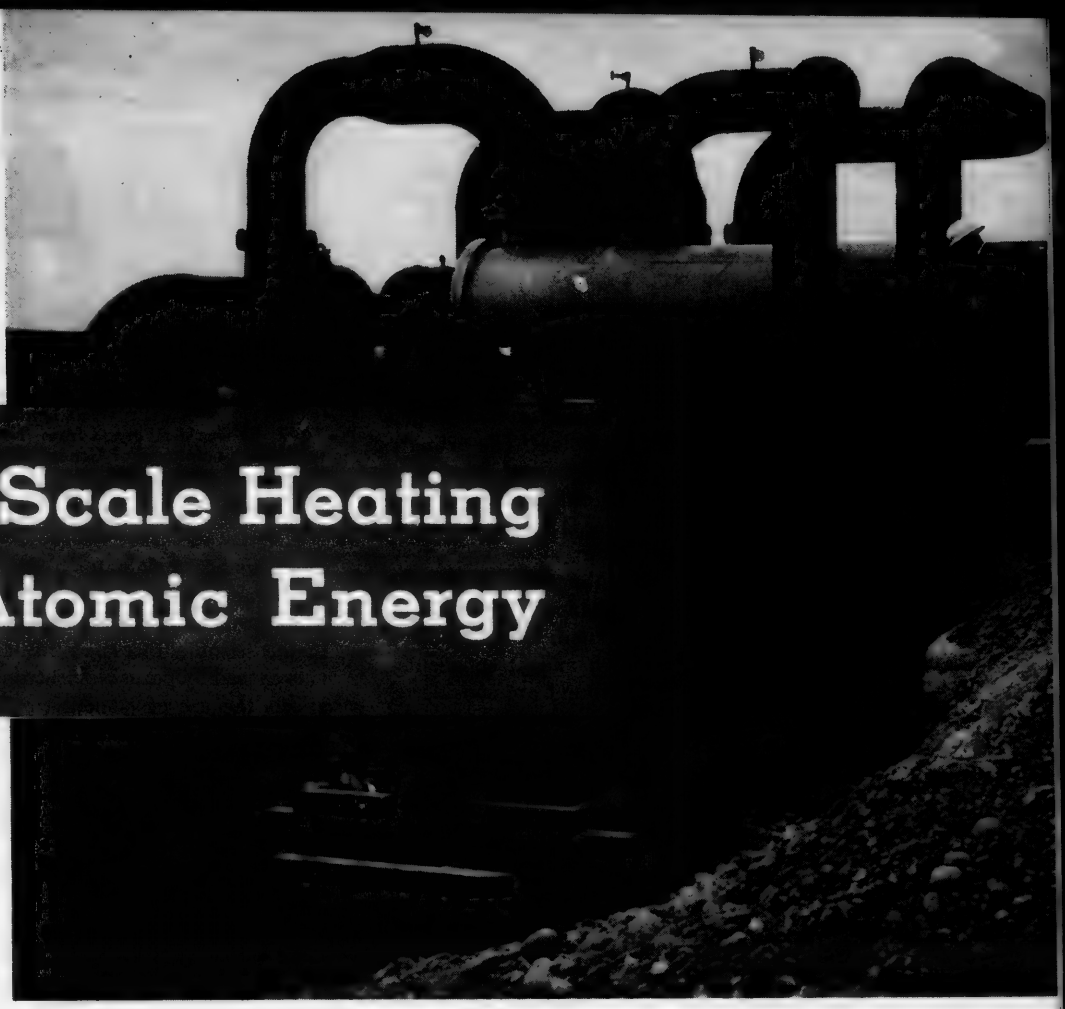
Large Scale Heating with Atomic Energy



Giant primary heat exchanger under construction

R. T. JASKE

Hanford Atomic Products Operation, General Electric Co., Richland, Wash.

Special problems in equipment size, air quantities, and radiation hazards are met in a heating system using atomic energy as a primary heat source.

EARLY in 1951 when the reactor process plant now under consrtuction at Hanford was being planned the utilization of waste effluent heat came up as one of the many economic gains provided in this newest plant design. There would be plenty of heat available from the effluent stream, but would the factors of low available temperature and radioactivity and sheer size combine to make such a system uneconomic? Accordingly, the following basis was established for any such proposal:

(1) It must satisfy stringent economic conditions.
(2) It must not create potential operational hazard which might limit plant productivity.
(3) It must be an effective design capable of fulfilling design objectives with a minimum of maintenance.
(4) No uncontrolled release of radioactive material must be possible.

The engineers of the General Electric Company and the Charles T. Main Co. architect engineers went to work on the problem and produced a design adequately meeting the objectives. The added expense over a conventional steam system will be amortized in a maximum period of 7½ years, a saving of $59,000 a year.

Those familiar with chemical plant design immediately recognize the necessity for large quantities of ventilation air required to reduce the concentration of toxic substances by dilution. A similar situation is met in the atomic field. The standards of health maintained by General Electric's Radiological Sciences Department have had an exceptionally favorable success in control of factors which could lead to radiation injury in the operation of Hanford.

The operation of a reactor produces incipient leakage of poisonous radioactive material into the surroundings. Large air flows, properly distributed, minimize these hazards, but the resulting cost of fuel is considerable. It has been estimated that the entire Hanford Atomic Products Operation uses in excess of 3,000,000 cubic feet per minute of outside air representing over 4,300,000 gallons

of fuel oil during an average heating season of 4500 degree-days.

The system itself is both simple in concept and in execution. It consists of three major elements connected by an appropriate system of piping. First, the primary exchanger, which transfers heat from the effluent stream to an intermediate fluid; second, the secondary exchangers, which transfer heat from this intermediate fluid to the air in central station apparatus; and third, a by-pass exchanger which is arranged to provide adequate heating when the reactor process is shut down. The latter exchanger is supplied with steam from a central station plant which is a part of the integrated plant. The primary purpose of the steam plant is to supply electrical energy to the plant in the event of outside power failure and no extra capacity for heating is considered in the sizing of the steam generators.

A network of piping connects the various process buildings with the primary heat exchanger. The exterior piping is all sub-surface and uninsulated, as the primary heat source is both abundant enough and at sufficiently low temperature that losses to the ground are considered negligible.

A simplified flow diagram of the system is shown in Fig. 1, and the important components identified. The diagram is arranged to show the approximate route of flow of the major lines. The secondary fluid is a 35% ethylene glycol-water solution which was selected because of the stringent requirements on continuity of operation imposed by the nature of the plant. The working pressures are all nominal, less than 100 psi in all cases, and no special materials or techniques have been used in the selection of equipment or layout of the system.

The plant heat load is about 50 million Btu per hr at the design temperature of −10 F. This load is divided among various process structures, the largest of which is the reactor building, requiring 50% of the entire load or 25,000,000 Btu per hr.

Radiological Factors

The operation of the fission process causes heat to be released in the fuel elements, tubes, moderator and shielding. This heat originates from a variety of sources among which are deceleration of fission fragments, moderation of neutrons and capture of gamma photons arising either in the fission process or from secondary reaction products caused by parasitic neutron capture. This latter factor affects the use of effluent water for heating as it causes the water to become highly radioactive. The resulting radioactive isotopes are in great variety, but the most significant to this case are the short lived (seconds) groups produced by neutron reaction with oxygen and the longer lived (hours) group induced in naturally occurring minerals or those added in the water treatment process.

Analysis of the total radiation emanating from a heat exchanger filled with this water indicated that in order to minimize shielding or space requirements the location had to be sufficiently remote to allow the oxygen activities to decay to where they are obscured by the activity from the longer lived isotopes. This level was then low enough to be met by space alone without shielding, although still high enough to be a hazard. The resulting location required about 1000 feet of supply and return piping but in the absence of shielding was economically justified.

The headpiece for this article is a photograph of the primary exchanger under construction. It consists of two units in series exchanging the heat from 10,000 gallons

Robert T. Jaske is a design and development engineer with General Electric's Process Engineering group at the Hanford Atomic Products Operation. He was born in Chicago, Ill., in 1923, attended Northwestern University, and received his B.S. in chemical engineering in June, 1944. After graduation he was associated with the Carrier Corps of Engineers, first at Oak Ridge trial training and sales engineer. He entered the U. S. Army in 1945 and performed atomic energy work for the Corps of Engineers, first at Oak Ridge and later at Hanford. In January, 1947, he was discharged from the army and remained at Hanford as an employee of General Electric to continue his work in the atomic energy field.

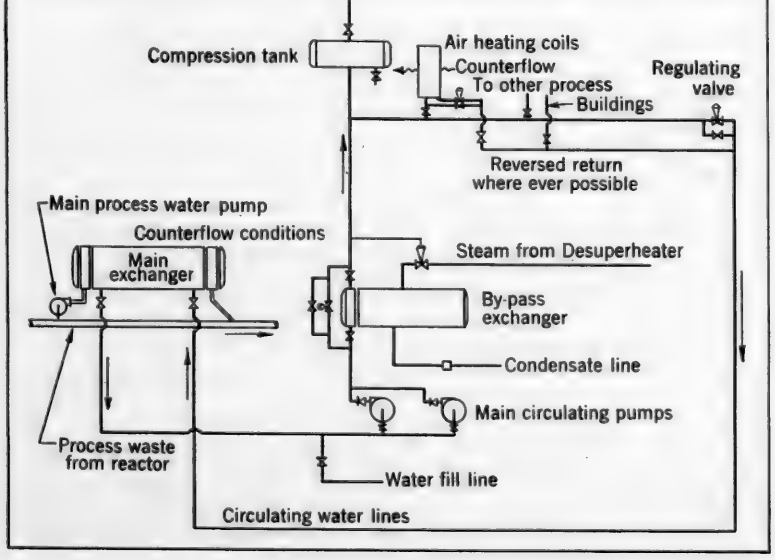


Fig. 1. Flow diagram of heat recovery system.

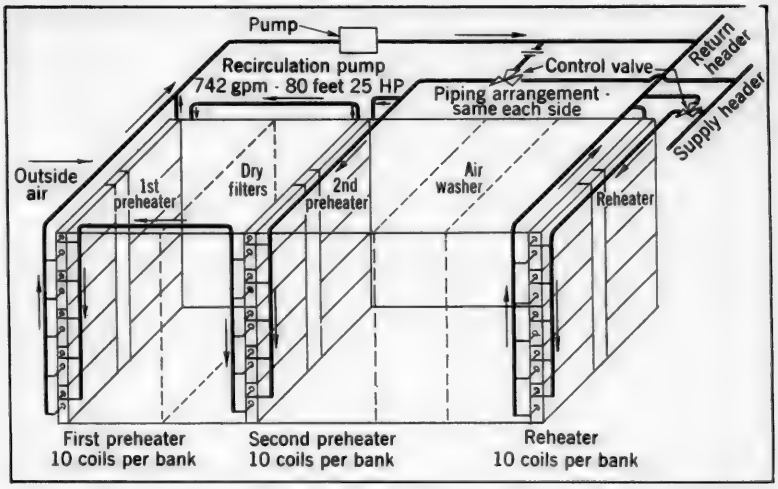


Fig. 2. Typical piping arrangement for one 84,000 cfm central station unit using 100% outside air.

of effluent to 4500 gpm of secondary circulating fluid. The resulting mass of water contained in the units is expected to produce a radiation level of about 500 mr per hour at one foot distance or less than 1 mr per hour at a distance of fifty feet. This latter value is normally conceded as a normal design target value for continuously occupied spaces, while the former value is 80 times the current radiation level permissible for an 8-hour day allowed at the Hanford Atomic Prdoucts Operation. In the absence of shielding a barricade fence will be erected at from 50 to 75 ft from the exchanger and be conspicuously marked as a radiation danger zone.

Maintenance, while expected to be somewhat complicated by beta and gamma activity from accumulations of corrosion products and film, should be no more a problem than those routinely met in the daily operation of the plant. The materials selected are expected to give excellent service life with the water used. The individual elements are relatively small and should permit ready handling. This is always an important consideration in designing for this type of service.

Should a leak occur in the interface metal between solutions, the flow will be from the secondary or glycol solution side to the primary or process water side. This summarizes the possibility of transfer of radioactive contaminants beyond the primary exchanger and allows termination of this consideration at this point.

Some Economic Factors

While the minimizing of the cost of isolation of those portions of the system subject to radioactivity constituted the most significant economic factors, several others involving straightforward problems were important to the cost picture. Among these are the direct burial of major lines, the use of anti-freeze solution as the secondary fluid, the need for the by-pass exchanger, and a method of control that would not unbalance the system.

The process buildings are closely integrated and are connected by utility tunnels used for process purposes. All of the distribution piping was carried through these tunnels with the exception of the two 500-ft lines to the main exchanger. Heat transfer calculations indicated losses to the soil of less than two degrees under most conditions.

Very high electrochemical resistivity and the loose gravelly nature of the soil tend to minimize both heat losses and corrosion. A coal tar enamel coating compounded for high temperature service has been used as a corrosion barrier as added insurance against corrosion attack. This type of construction is estimated to have saved $60,000 over the cost of a utility tunnel.

Due to the low temperature of the secondary stream, coil freeze-ups resulting from improper distribution were anticipated. Contact with coil vendors produced confirmation of this possibility, since on occasion the temperature goes down as low as minus 28F and some difficulty has been experienced in keeping regular non-freeze type steam coils operating. Considerable thought went into the selection of the anti-freeze system after the decision to use this protection was established because of the continued need for strictest economy in the design.

The ordinary acceptable anti-freeze materials considered were methanol, ethanol, isopropyl alcohol, propyleneglycol and ethylene glycol. Since the heat transfer properties are very critical in this system, no effort was spared to justify the use of a secondary fluid most resembling water in its heat transfer properties. A 26% methanol water solution was closest to this ideal. The results of the investigation are summarized in Table 1.

TABLE 1—COMPARISON OF POSSIBLE ANTI-FREEZE MIXTURES

Solution	Freezing Point	Surface Area Ratio
Water	32°F	1.00
34% ethylene gylcol, 66% water	0°F	1.23
10% methanol, 22% ethylene glycol, 68% water	0°F	1.13
26% methanol, 74% water	—5°F	1.12

It is easy to see that in a system containing several thousands of gallons of fluid and affecting thousands of square feet of transfer surface the lowest priced anti-freeze-surface combination should be used, but due to considerations of safety, flammable materials had to be excluded from use. It is estimated that an overall saving of $32,000 could have been made by the use of the methanol-water solution rather than the glycol-water solution actually selected. The low flash points of any of the methanol solutions (110 to 140F) was considered

too great a hazard to a multi-million dollar plant to merit further consideration.

The need for heating and ventilating is constant even though the reactor itself is not operating. In fact, some of the greatest ventilation demands come as a result of the release of contaminated material during maintenance operations. This requires a secondary source of heat, which is supplied by by-passing the flow of the secondary stream through a by-pass exchanger located in the same building as the emergency steam generators. Steam is available at 400 psi and 700F. The primary purpose of the steam system is to supply power to a turbine-generator emergency power system which is required to maintain a flow of electrical power to the process pumps in event of failure of regular power sources. This by-pass exchanger can also be employed to boost the secondary fluid temperatures should the reactor effluent temporarily fall below design conditions.

The by-pass equipment consists of the exchanger itself, a pair of circulation units, a desuperheating station which is also used for routine steam supply to a water studies laboratory and emergency process equipment. A central control panel is located in this area. This control will be of the graphic type so the operator sees the entire flow sheet represented on the board, animated by indications of actual conditions at key points. The entire operation will be automatic, needing only occasional adjustment.

Fig. 4. Size of central station unit is indicated by this view taken during construction.

Air Handling Equipment

As stated earlier, due to the leakage of small amounts of radioactive gases and particles from the reactor, a large quantity of fresh ventilation air is required for reasons of health and safety. For this and process reasons, a flow of 168,000 cfm of outside air is required in the main process building with supplementary unit and booster heaters representing an additional heat load of 8,000,000 Btu per hr. The entire heat load is about 25,000,000 Btu per hr in the main building.

In order to permit constant flow of air, two large parallel air handling systems are to be used, each handling 84,000 cfm. However, the fans and coils are sized sufficiently large to permit a maximum flow of 140,000 cfm through each with some reduction in the air temperature. This will allow one unit to be temporarily shut down for short periods of time without seriously curtailing the flow of air to the buildings, as curtailment would mean shut down of the entire plant. The basic arrangement of one of these systems is shown in Fig. 2.

Operation of the air washers of the capillary type continues all year round, a requirement imposed by the extremely fine dust which prevails in the desert areas and passes through ordinary air-mat type filters. Should one unit be shut down the other can heat a flow of 140,000 cfm from −10F to 73F. During this period the air washers will be shut down and reasonable conditions can be maintained.

Control of air temperature is based on by-pass of the

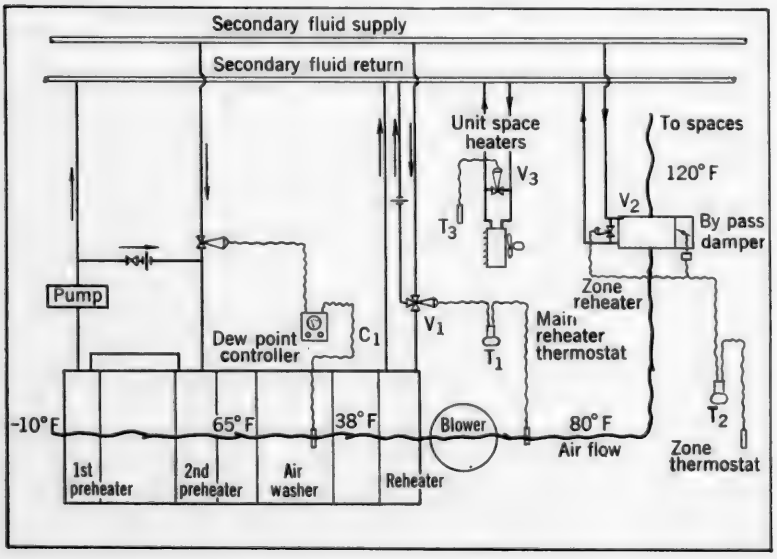


Fig. 3. Arrangement of central station equipment and controls.

secondary fluid. Fig. 3 illustrates the basic configuration of the piping arrangement for the main system, the zone reheaters and the unit heaters. The heating fluid can pass either through the coils or a fixed by-pass depending on the position of the 3-way control valve. In the case of the main preheater banks, an auxiliary circulating pump is required because of the large pressure drop in the coil compared to the requirements of the over-all plant system. The air handling units will operate on a year around, fixed dewpoint basis, using a dewpoint setting of 38F. Since the air washer saturates the air to about 97% efficiency, it can be assumed that the air leaving the washer is at its dewpoint. This provides a constant control point regardless of the temperature of the outside air up to about 65F, above which the dewpoint will rise.

The sensible heat load in the building is taken care of with branch reheaters, the main reheater in the central equipment supplying air of constant temperature for ventilation purposes. No control is actually needed, although a control valve is installed to compensate for changes in secondary fluid temperature. The branch reheaters use typical controls for hot water heating applications.

As stated previously, the exceptionally large quantities of outside air and the low temperature of the heating fluid form the unusual features of this part of the system. In the air conditioning field it is a rarity to exceed 100,000 cfm of outside air in one unit, and even when done, steam invariably forms the heat source and special non-freeze type heat exchange coils are required. Fig. 4 shows one of these large units.

The author acknowledges use of data prepared by W. L. Pearl and B. O. Shaver of the staff of the General Electric Company and other source material obtained from the engineers of the Charles T. Main organization.

Heat and Water Vapor Transmission Apparatus for Insulated Panels

An apparatus designed for measuring water vapor permeances of insulated panels has recently been developed by H. E. Robinson, F. J. Powlitch, M. A. Barron and P. R. Achenbach of the National Bureau of Standards. Designed and constructed at the request of the Office of the Quartermaster General, Department of Defense, the apparatus will be used to obtain practical criteria for designing refrigeration warehouse panels which are not subject to damage due to internal condensation of moisture. Elimination of condensation and water accumulation would not only result in better control of temperatures but would prevent rapid deterioration of the panels due to decay or corrosion of their components.

Essentially, the apparatus consists of two parts coupled together to form a large, well-insulated enclosure. The test panel, 4 by 8 ft., is installed in one section against a gasketed stop in such a way that, when the apparatus is closed, it divides the enclosure into a warm side and a cold side.

Both sections are constructed using 2- by 4-inch softwood framing with ¼-inch plywood glued and screwed to its inner and outer faces. Framing was kept to a minimum consistent with structural requirements to reduce heat conduction through framing members. The spaces between the plywood sheets are filled with slightly compressed layers of 2-inch low-density glass fiber thermal insulation. Both sections are also lined on the inside and covered on the outside with 0.006-inch aluminum sheet for vapor proofing; however, heavy polyethylene sheet is substituted for aluminum sheet on the inner warm side surface at the stop and at the joint between the hot and cold sides to reduce heat conduction to the cold side.

The apparatus was designed for warm side air temperatures up to 150F, with relative humidities up to about 90%. The cold side was designed to attain temperatures as low as 100 degrees below the room temperature, or about minus 30F, and relative humidities from about 20 to 70%. By means of automatic controls, temperatures and humidities on the two sides of the panel can be maintained for long periods of time at almost any desired conditions simulating those encountered in field use.

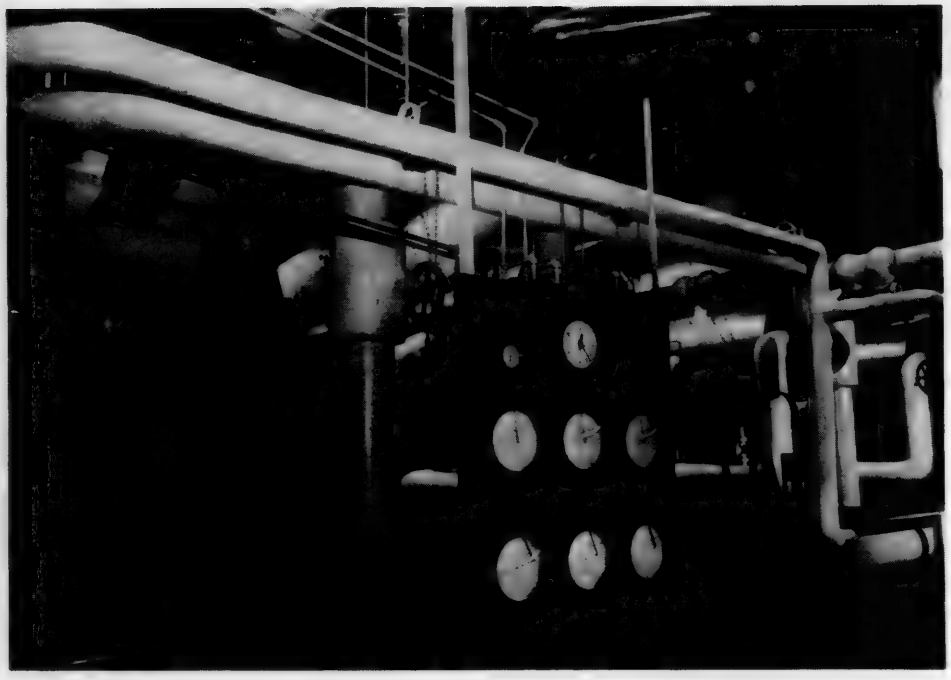
In service the orientation of a panel—depending on its use as a wall, floor or ceiling of a refrigerated chamber—may markedly affect its performance, especially with regard to moisture accumulation effects. To permit studies in different orientations, the entire apparatus is mounted on horizontal trunnions so that it can be rotated 90 degrees in either direction (in a vertical plane), thus orienting a panel in either wall, roof or floor position.

When under investigation, a test panel is exposed to desired temperatures and vapor pressures on both sides over long periods, during which heat flow through the panel and vapor flow into and through the panel can be periodically observed. Measurements of the heat flow, or of its changes, provide an indication of the effect of moisture accumulation on overall insulating value, and they indicate indirectly whether moisture is accumulating in the panel. Direct measurements of vapor flow into and out of the panel are also made.

The air temperature on the warm side is maintained constant by small electrical resistance heaters in a cylindrical tube through which air is circulated by a fan. Selected heaters are energized continuously, and one or two energized intermittently under the control of an electronic time-proportioning thermostat whose sensing element is located in the air on the warm side of the panel. On the cold side, the air is cooled to a temperature slightly below the desired value by means of a flooded direct-expansion cooling coil through which air is circulated.

Determination of heat flow through the panel is made by measurement of the average electrical energy input into the warm-side and of heat losses from the same side through all paths except that through the test panel. The difference is that going through the panel. Electrical energy input is measured by an integrating watt-hour meter.

The rates of flow of water vapor into the warm-face of the panel, and out of its cold-face, were determined periodically during a test. These measurements are based on the average rates at which it is necessary to evaporate water on the warm side, and to absorb vapor on the cold side by a dessicant (silica gel) spread out in eleven wire mesh trays, which are weighed periodically.



Four absorption type refrigeration units are installed on the roof of the Sinclair Oil Building, New York City.

How Steam Is Saved in Operation of an Absorption System

JOHN ARENA

Chief Engineer, Sinclair Oil Building, New York, N. Y.

Efficient operation and maintenance has resulted in low steam consumption for four absorption type refrigeration units used to air condition the Sinclair Oil Building in New York City.

THE company that installed the absorption type refrigeration system in the 27-story Sinclair Oil Building, an office building at 48th Street and Fifth Avenue in New York City, claimed that the steam consumption would average 19.5 lb of steam per hour per ton of refrigeration. However, through alert and efficient operation and maintenance, the steam consumption for this refrigeration system has averaged 16.8 lb of steam per hour per ton or a saving of 2.7 lb of steam per hour per ton refrigeration over the manufacturer's rating.

The system consists of four 275-ton Carrier absorption units installed on what would normally be the roof of the building and on this same floor there are three 60 hp condenser pumps with one serving as a standby. Two cooling towers are located on a supporting structure above the refrigeration equipment. Therefore, all of the refrigeration machinery is in the upper part of the structure and the operating engineer has the heart of his air conditioning equipment best placed for finger tip control. There is also a saving in time, for the operator can check his towers and be back to his equipment for other duties in a few moments.

Steam for this 1,100 tons of refrigeration is purchased from the Steam Service of Consolidated Edison of New York, Inc.

Returning to the matter of steam consumption, when the system began operating, we found the steam per hour per ton to be running somewhat higher than that for which the machines were rated. We began an immediate investigation, first holding a conference with the operating engineers. The result was that we found at morning start-up, the man on watch had to bypass the bucket traps to get 237F solution temperature. These traps could not discharge the condensate fast enough. In taking these traps apart we found two buckets were inoperative and the other two traps had badly scored seats.

New traps were installed with 3½-inch diameter sight glass. The watch engineers now take pride in checking to see if the traps leak any steam. The two traps installed on No. 1 and No. 2 absorbers have been in for two seasons

and have not leaked yet. They have done away with the wasteful practice of opening the bypass valve.

Before getting into a critical anlysis of how this steam saving was accomplished, let us first examine some of our operating and maintenance procedure.

Summer Operation and Maintenance

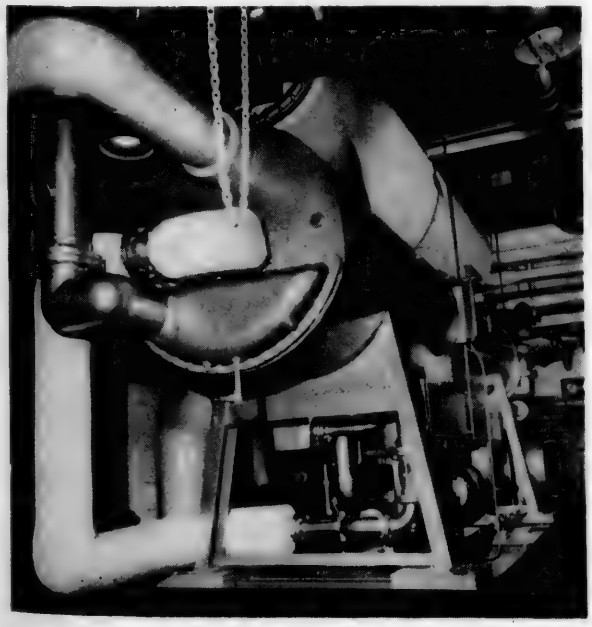
During the cooling season, the duties of our operating engineers follow:

1. Take all reading before start up of the refrigerating units.
2. Check the four manometers for air leaks. This system must maintain 29.5 inches of vacuum.
3. Start condenser pump or pumps as the load requires.
4. Start the water and steam jets for purging the absorption equipment.
5. Start the chill water pump.
6. Start the solution pump on absorber. The solution pump is the only moving part on the lithium bromide machines.
7. Set switch to start. By setting switch to run position, this opens steam valves to generator and also controls steam pressure when the chill water has dropped to 55F.

These seven simple steps are all that one must follow in starting this equipment. The chill water temperature will drop in 20 to 30 minutes and you are on the line for cooling.

To Shut Down for Night or Week End Periods

The same routine is followed in shutting down at night or for a week end, except that a ½-inch line called the diluting line is opened. This valve is opened until the solution pressure drops from 54 psi to 50 psi pressure. By doing this, the strong solution is diluted for storage at night and is pumped to the generator. The next step is to close the solution valves, main steam valve, water jet purger, and steam jet purger followed by closing the condenser pump and the chill water pump. Now the system is secured for one night or a long week end.



End view of one of the absorption units.

During the operating season, the chief engineer should check his log sheets of the previous day's work, so that he can notice the performance of his equipment. Among the important items to be checked are:

1. Steam Consumption—is it high for the tonnage of equipment in use.
2. Condensing water temperatures, entering and leaving the absorbers and generators.
3. Solution pressure in the absorber machine. If this pressure is low, he should immediately check with his engineer to see that he is not over-boiling in the generator or that the solution is being carried into the chill water circuit. This can be checked on the chill water gage glass. If the level is a little high, drain some chill water to a safe level. While this rarely happens, when it does, it must be corrected before it becomes troublesome.

Safeguard Against Leaks

The successful operation of an absorption machine depends on maintaining a tight system, free from leaks. Should the operator notice that one manometer has a higher reading than the other three, he knows through training not to start the machine with the high reading. As reserve capacity is usually available to the engineer, it would still be possible to air condition the building with the three machines. After these units have been started, he can start looking for the leak by using the following procedure:

1. Put 3 to 4 lb of Freon into the system, remembering the system is under a vacuum.
2. Add nitrogen until the pressure gage reads 8 to 10 psi.
3. Test for a leak with a halide torch using the same procedure customarily followed in hunting any Freon leak.
4. When the leak has been located, repair it at once.
5. Release both nitrogen and Freon to the atmosphere and start the purgers working again. This purging will take about five to six hours.

While a leaking compressor can lose valuable Freon refrigerant because the refrigerant is under pressure, lithium bromide cannot be lost to atmosphere due to leaks.

The watch engineer must also check for any indication that the steam jet nozzle has become clogged. To clear this obstruction, all he will have to do is shut the ½-inch valve feeding jet, back off the ¾-inch plug, stick a wire through the steam nozzle to dislodge any dirt or obstruction, then cautiously turn steam on without the plug to clear the line of any other obstruction.

Operation Economy

How can one get the most out of his equipment without injuring it or causing any discomfort to tenants? The following is my simple procedure:

1. Never overcool your building. I would rather get one or two "too warm" complaints than one or two "too cold" complaints.
2. In winter never overheat because you are wasting the owner's money.
3. Put yourself in the position that you own the building, or you are a shareholder in the company.

How Savings Can Be Accomplished

When starting up the system on a heavy, humid day, with three of the four absorbers on the line and the chill water temperature down to the design temperature of 41F, the operating engineer should watch the spread between the wet and dry bulb readings. As soon as he notices a 12 to 13F or more spread, he should cut one absorber off the line.

The air conditions may be, dry bulb temperature, 90F; wet bulb temperature, 77F; relative humidity, 56 per cent.

One absorber off the line represents a saving of 4,680 lb of steam per hour. During a four-hour shut down, this represents a saving of 18,720 lb of steam. This saving can be drawn on when operating during a heavy-load day, and there will be a steam saving for the owner.

In the following summary of operating energy costs, a comparison is made of the cost of steam and electricity (for auxiliary equipment) for the summer of 1953 with the equivalent estimated costs for an electric motor compressor system and auxiliaries to produce the same amount of comfort cooling. In this comparison, only the cooling tower, condenser water and other auxiliaries peculiar to the refrigeration cycle have been considered. Motors for air handling and chilled water pumping common to both systems have been omitted.

Steam Absorption Plus Electric Aux.		Elec. Motor, Compressor Plus Elec. Aux.	
13,650,000 lb steam	$10,000	872,000 kwh	$17,000
23,500 kwh.	4,000		
			$17,000
Total	$14,000		14,000
		Saving	$3,000

Winterizing the Units

This type unit, as well as any refrigeration units that are under my supervision must have a yearly inspection. There is no such saying as: "Oh it ran good all summer, better leave it alone." It may be of interest to relate how our crew winterized the four absorption units.

1. The solution is taken out of one of the machines by connecting a hose on top of the pump, starting the solution pump, and discharging the solution into a solution drum.
2. Now that the solution has been evacuated, we take the heads off the generator shell, and absorber shell, and start cleaning our tubes. Of course we install new gaskets every time. Never say that the gasket came out clean and therefore it can be used again because it is still attached to the heads. A chance is taken and in 9 out of 10 chances, the gaskets will leak and will, therefore, cause double work.
3. We take out our solution spray header, and unscrew each of the 104 nozzles so that they can be washed, wire brushed and flushed thoroughly.
4. Being under a vacuum for 25 ft from the top of machine to about the 26th floor, the machines are supplied with Hills McCanna diaphragm-valves. These valves are taken apart every year and checked. Where needed, the diaphragm is renewed, because should the diaphragm become loose, a low chill water flow would result even though the valve is wide open.
5. After the completion of the cleaning and testing program, we pressurize the system with 3 to 4 lb of nitrogen.

Bugs

As refrigeration equipment goes, the absorption machines are easy to operate and comparatively free of bugs. There are, however, operating problems that we must be prepared to meet. In my experience these problems, readily taken care of by the operator, are less troublesome than I have encountered in the operation of reciprocal and centrifugal compressors.

(1) *Crystals in Line.* In starting, the Mercoid pressurestat located on the discharge of the solution pump, some solution may have crystallized in the line and, therefore, the solution pump won't start. In getting to this problem easily, we usually tap the line gently or apply a little heat to melt the salt in the line.

(2) *Erratic Cycling of Controls.* This is usually caused by an excess amount of water going to the condenser and not enough to the absorber. If you have an automatic Bellfield valve, it should be adjusted manually to a ratio of approximately 3:1, that is three times as much water going through the absorber as through the condenser.

(3) *Low Machine Capacity.* After machines have been operating a considerable amount of time, the solution spray nozzles or strainer may be clogged. Check pressure drop across spray header; if it proves clogged, remove spray header and flush with water or clean with proper inhibited cleaning solution recommended by manufacturer.

(4) *Sweating of Absorber Shell.* Sweating of absorber shell may be an indication of a leak in the evaporator tank or an over-loaded machine. Or it may also be caused by trying to pump an excessive amount of chilled water.

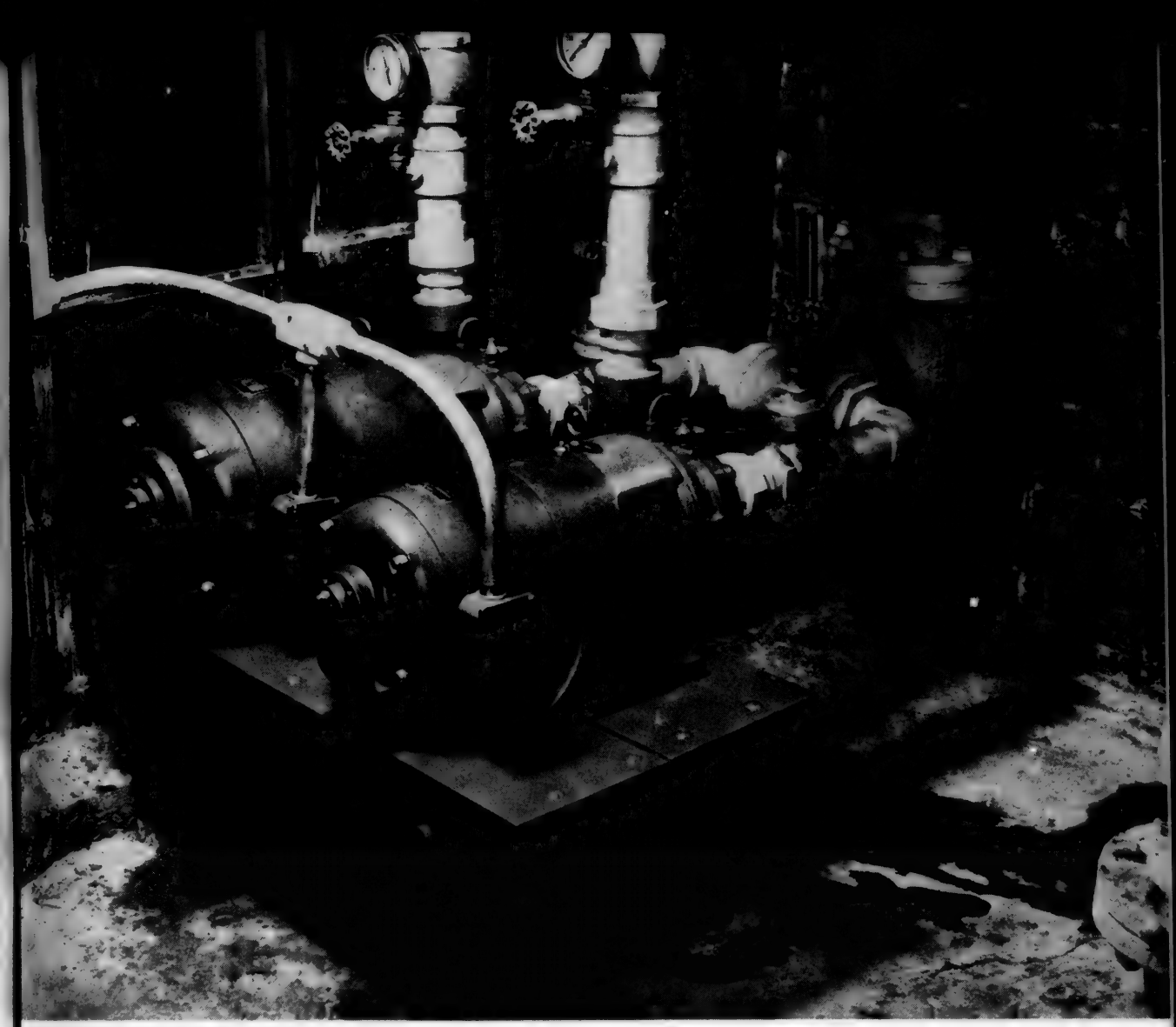
(5) *Surging of chilled water pump or heavy hammering in chilled water lines.* Check the chill water level and raise it to a safe level.

(6) *Steam jet not functioning properly after a thorough cleaning.* Check to see that the nozzle is not wire drawn. If so, install a new nozzle orifice. Be sure to get the proper size as every absorber size machine has its own orifice sizes.

(7) *Reduction of capacity in machine.* After considerable hours of operation this may be caused by any of the following:

a. The absorber and condensing tubes may have become dirty.
b. The bypass condensing strainers and the main condensing water strainer may be clogging up.
c. Strainer, or steam trap in steam condensate line may be clogged, resulting in condensate filling a portion of the steam coil.
d. Steam coil in generator may be fouled, although this is very unlikely.
e. The solution spray nozzles in absorber may have become clogged resulting in improper wetting of the absorber tubes and a resulting low flow of solution to the absorber.

To sum up, the roof top absorption installation at 600 Fifth Avenue has proved entirely satisfactory in regard to meeting the building requirements winter and summer.



Stop Leaks with

Stuffing Boxes and Packing for Centrifugal Pumps

IGOR J. KARASSIK and ROY CARTER

Centrifugal Pump Division, Worthington Corporation, Harrison, N. J.

Sixth in a series of integral articles on components, design factors, and selection criteria for centrifugal pumps.

THE stuffing boxes of a centrifugal pump and the manner in which they are packed are a most important factor in the successful operation of the pump.

All stuffing boxes, regardless of the service for which the pump is intended, have the function of packing the shaft against leakage at the point where it passes out through the casing. However, there are several variations of this function and of the manner in which it is performed. When the pressure at the interior end of the stuffing box is above the atmospheric pressure, the function of the stuffing box is to prevent leakage of the liquid out of the pump. On the other hand, its function is to prevent leakage of air into the pump, when the pressure inside the stuffing box is below the atmospheric pressure.

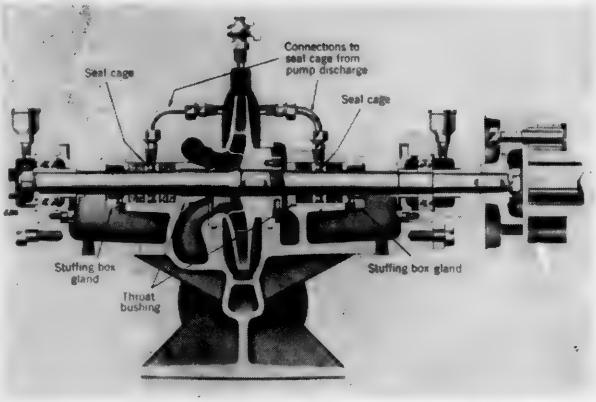


Fig. 1. Conventional stuffing box with water seal cage.

Seal Cages

In order to provide against air leakage into the pump when operating on a suction lift or under a vacuum, a water seal cage or lantern ring is fitted into the stuffing box, as in Fig. 1. For ease of assembly, seal cages are generally split axially, as shown in Fig. 2. Water or sealing fluid under pressure is piped to the chamber formed by this seal cage and makes an effective seal beyond which air cannot pass into the pump. This seal chamber also provides a reservoir of water or fluid for cooling and lubricating the packing rings. A seal may also be used to prevent the outflow of the pumped liquid into the atmosphere when this liquid is inflammable or chemically active and dangerous.

Certain installations involve variable suction conditions, where the pump operates part of the time with head on suction and part of the time with a suction lift. When the pressure inside the pump is above atmospheric, the function of the water seal cage is inoperative (except for lubrication) when the pump is in operation. However, it is still provided so that when priming the pump at starting, all the air can be excluded.

When the pump is handling clean cool water, stuffing box seals are usually connected to the pump discharge. (Fig. 1.) An independent water sealing supply should be provided under the following conditions:

(a) When the suction lift exceeds 15 ft;
(b) When the discharge pressure is less than about 10 psi or 23 ft head;
(c) When pump is handling hot water over 250F where adequate cooling is not otherwise provided (except in boiler feed service, where undeaerated water would contaminate the boiler feedwater);
(d) When the water is muddy, sandy or gritty;
(e) On all condensate pumps taking their suction from a condenser hotwell.

Fig. 2. Water seal cage.

In some pumps, the connections to the seal cage are arranged so that the sealing liquid can be introduced into the packing space through either an internal drilled passage from the pump casing or from an external source, using either clear water or some other sealing fluid. Fig. 3 and Fig. 4 illustrate the use of the seal cage connections. In Fig. 4-A, which is the general service arrangement where the pumped liquid is used for sealing, the external connection is plugged. If an external source of sealing water is required, it is connected to the external pipe tap and a socket head pipe plug inserted at the internal pipe tap, as in Fig. 4-B.

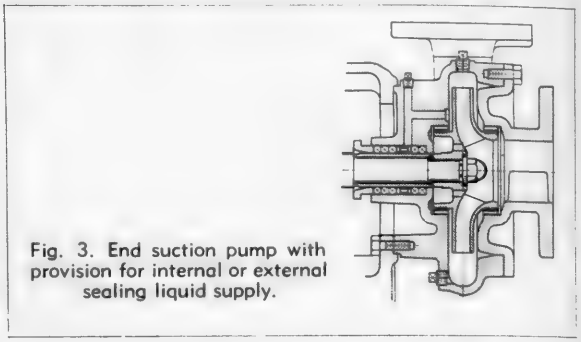


Fig. 3. End suction pump with provision for internal or external sealing liquid supply.

The seal cage should be close to the pump interior when an abrasive liquid is handled, so that the clear sealing liquid will flow into the pump and keep the packing free from abrasives. When a minimum of dilution is desired, the seal cage should be located away from the pump interior. The recommended locations of the seal cage are illustrated in Fig. 5.

For intermittent service and other duties when water or other clear liquids cannot be used or are not available, a grease seal may be effective. This type of seal is also used on low head drainage pumps operating with a suction lift and often with a discharge pressure below atmospheric because of a syphon system. Grease seals are most usually applied to pumps handling sewage.

Throat Bushings

Some stuffing boxes are fitted with a throat bushing which is a removable piece forming the bottom of the

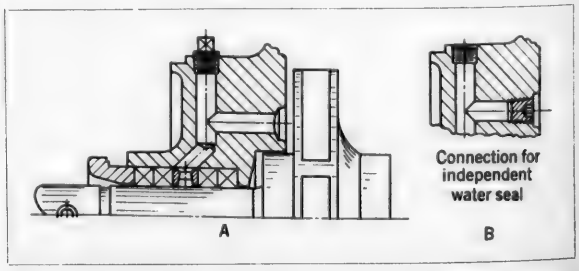


Fig. 4. Arrangements for sealing connections: (A) Internal seal; (B) independent seal.

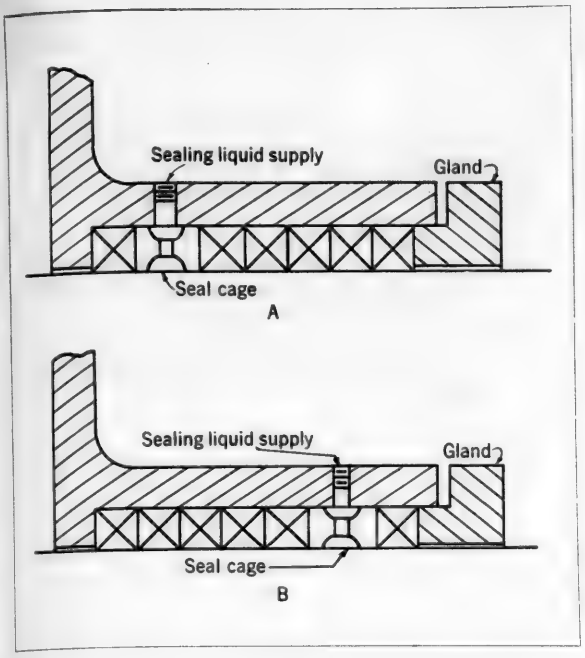


Fig. 5. Recommended locations of seal cage: (A) When pumping abrasive or corroding liquid; (B) when pumping clear liquid and minimum dilution is desired.

stuffing box. This bushing is always solid rather than split, even though the casing in which it is fitted may be axially split. It is generally held from rotation by a locked tongue-and-groove joint in the lower half of the casing. (See Fig. 1.)

The use of stuffing box throat bushings is based mainly on manufacturing problems rather than on any particular advantage in operation. They are generally applied to pumps of small size, when the diameter of an integrally formed stuffing box throat would limit the size of the boring bar used to machine the casing to an impractically small diameter. They are also used on pumps when the bottom of the stuffing box is subject to severe wear because of abrasive pumping conditions. The bushing then can be replaced when necessary to restore original clearances.

Stuffing Box Packing

Basically, packing that is placed in a stuffing box is a pressure breakdown device. The packing must be somewhat plastic so that it can be adjusted for proper operation. It must, however, be of such consistency that it does not break down when absorbing energy and does not damage the rotating shaft or shaft sleeve. In a breakdown of this nature, energy of friction is liberated and this energy generates heat which must be dissipated in the fluid leaking past the breakdown or by means of cold water jacketing, or both.

There are numerous types and materials of centrifugal pump packing, each adapted to some particular class of service. Some of the principal types are discussed as follows:

(1) Asbestos packing is comparatively soft and is suitable for cold water and hot water applications in the lower range of temperatures. It is the most commonly used type for general service under normal pressures. For pressures above 200 psi, this packing is not suitable, except at very moderate rubbing speeds. Such packing is pre-lubricated either with graphite or some inert oil.

(2) Metallic packing is composed of flexible metallic foil or strands with a graphite or oil lubricant impregnation and with either an asbestos or a plastic core. This impregnation makes the packing self-lubricating for its starting up period. The foils are made of various materials, such as aluminum, babbitt, copper or lead. Babbitt foil is used for low and medium temperatures on water and oils (up to 450F) and medium to high stuffing box pressures. Copper is used for medium to high temperatures and pressures on water and low sulphur content oils. Aluminum is mainly used on oil service, also for medium to high pressures and temperatures.

Many other types of packing are commonly furnished to meet customers' specifications, such as hemp, cord, braided type, duck fabric, chevron types, etc.

Packing is supplied either in continuous coils of square cross-section or in preformed die-molded rings. When coil type packing is used, it is cut from the coil in lengths of proper size to make up individual rings. The ends are cut with a diagonal, or scarf joint and with a slight clearance to provide for expansion and avoid buckling. The rings have a tendency to swell due to liquid action and rise in temperature and the scarf joint allows the ends to slide and absorb the expansion laterally.

It is much preferable, where possible, to use die molded packing rings which are available to exact size and in sets. A molded packing ring insures an exact fit to the shaft and to the bore of the suffing box and establishes an equal density of packing throughout the stuffing box.

In a great many cases, more efficient packing life can be gained by the use of a combination of two or more different kinds of packing, such as for instance alternating hard and soft rings. Such sets are generally available in

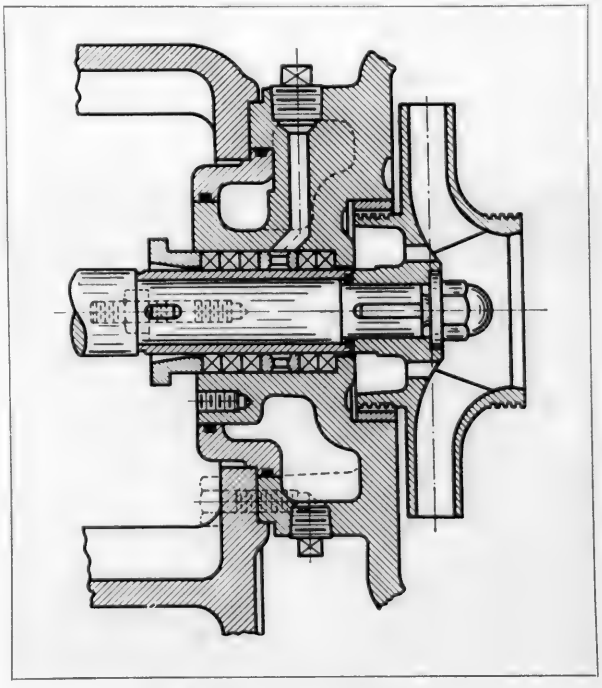


Fig. 6. Water cooled stuffing box.

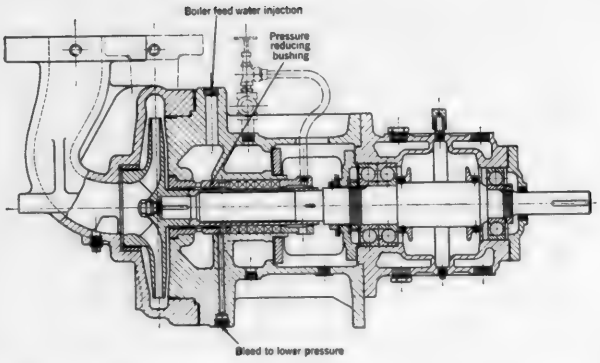


Fig. 7. Pressure breakdown and injection arrangements in a stuffing box of pump handling high temperature water.

standard die-formed ring combinations from most reputable packing manufacturers.

For best results, the shafts or shaft sleeves should be in perfect alignment and concentric with the axis of rotation, should operate without vibration and should be highly polished. The choice of the material of the shaft or shaft sleeves is extremely important to the life and maintenance of the packing.

Water-Cooled Stuffing Boxes

The problem of maintaining the packing in a stuffing box is made more difficult with high temperatures or high pressures. Pumps handling hot liquids or having stuffing boxes subjected to high pressures are generally provided with water jackets to which cooling water is supplied as in Fig. 6. This cooling water removes the heat from the liquid leaking through the stuffing box as well as the heat generated by friction in the stuffing box, thus improving the conditions under which the packing has to operate.

Pressure Reducing Devices

The limiting pressure and temperature conditions, against which it may be possible to pack a stuffing box successfully, vary with the type of pump in question. It may not be economical to equip a pump intended for moderate service conditions with an expensive type of stuffing box

Fig. 8. Graphited asbestos in continuous coil, courtesy John Crane Co.

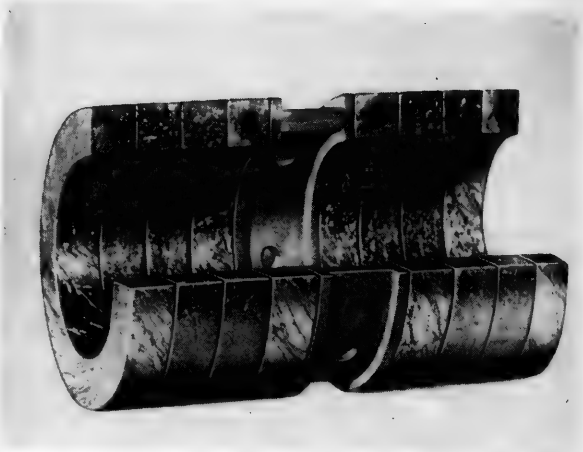


Fig. 9. Combination set of hard and soft packing, courtesy John Crane Co.

for the infrequent applications when such a construction would be needed. Therefore, whenever the limitations imposed by the manufacturer on the stuffing box conditions for a given pump are exceeded, it becomes necessary to use some form of pressure reducing device ahead of the stuffing box proper.

Essentially, these devices consist of a bushing or a meshing labyrinth located between the pump interior and the stuffing box proper and ending in a relief chamber. The latter is connected to some point in the installation where a suitably low pressure is established and the leakage past the pressure device is returned to this point. When the liquid pumped must be salvaged, as for instance in the case of treated feedwater, it is returned back into the pumping cycle. If, on the other hand, the liquid can be wasted, the relief chamber may be most conveniently connected to a drain. Fig. 7 illustrates the use of such a breakdown device in a pump used for hot water circulation (above 400F). In this case, the use of the breakdown is combined with cold water injection which is introduced ahead of the breakdown under a pressure exceeding the suction pressure. Part of the injected water flows into the pump and part of it in the direction of the packing, so as to prevent contact of the packing with the high temperature water handled by the pump. Packing materials are shown in Fig. 8 and 9.

Stuffing Box Glands

Stuffing box glands can be classified into two groups, solid glands and split glands. Split glands are made in halves so that they may be removed from the shaft without dismantling the pump to provide more working space when the stuffing boxes are being repacked. They are desirable on severe service, where the pumps have to be repacked frequently especially if the space between the box and the bearing is too restricted. The halves of split glands are generally held together by bolts, although other designs are also used. Split glands are generally a refinement of construction, not a necessity, and are rarely used in the smaller sizes of pumps.

Next month, the authors take up the subject of mechanical seals and show the various constructions and arrangements.

Instruments for Measuring Air Flow and Metering Air

KNOWLTON J. CAPLAN

Measuring air flow and metering air is a subdivision of the broad general subject of fluid flow. In view of the large background of literature on general fluid flow, no attempt is made to give complete coverage here. Rather, attention will be devoted to instruments most suited to those situations in ventilation, industrial hygiene, and related fields where there is a specialized need for rapid measurement in problems quite different from ordinary fluid flow. This reference section is based on a paper presented by the author before the May, 1954, symposium on instrumentation for industrial hygiene at the University of Michigan School of Public Health, proceedings of which will be published at the University in a forthcoming Encyclopedia. Sufficient data are presented here to enable practical selection and use of instruments, with avoidance of the more common types of errors.

THE purpose for which an air flow measurement is being made affects the selection of the instrument, the location of the measuring station, and the technique employed. For instance, air velocity is at times measured because the velocity itself is the question at hand, but more frequently the velocity is to be used in connection with calculations or estimates of the volume of air flow. A knowledge of air velocity alone may be desired in connection with iso-kinetic sampling; for certain considerations in human comfort problems; or in connection with control of contaminants around various processes or equipment.

Most air velocity measurements are taken in connection with measuring the volume flow of air, using the basic equation,

$$Q = VA$$

where Q = volume flow per unit time
V = average velocity through a plane perpendicular to direction of flow
A = cross-section area of the flow (any consistent units)

The volume flow of air may also be determined by use of any of the various metering systems, such as the orifice, flow nozzle, displacement meters, etc. Such metering elements are usually used where small air flows are involved, as in laboratory set-ups, field sampling equipment, and the like. Large air flows as encountered in exhaust systems and ventilating systems are usually calculated from measurements of air velocity and cross-section of flow.

Air Flow in Unconfined Space

Measurement of air flow in an unconfined space such as a workroom usually involves measurement of velocity only. Air issuing from an opening into an unconfined space forms a jet, entraining ambient air in turbulent fashion and spreading at an included angle of about 20°. At several diameters from the opening, the jet assumes a round shape in cross-section regardless of the shape of the opening. Any of the instruments for measuring air velocity may be used to determine velocities in the jet pattern, but those with a small sensing element and non-directional characteristics are usually better since the exact direction of the jet is hard to determine. Attempts at measuring total air flow in such a jet must involve velocity readings at a number of points in the flow cross-section and results should be regarded as good estimates only. In laboratory work concerning jet patterns, cross-section grids of threads or fine wires, mounted on frames larger than the flow cross-sectioned, are used to locate reproducible points of measurement.

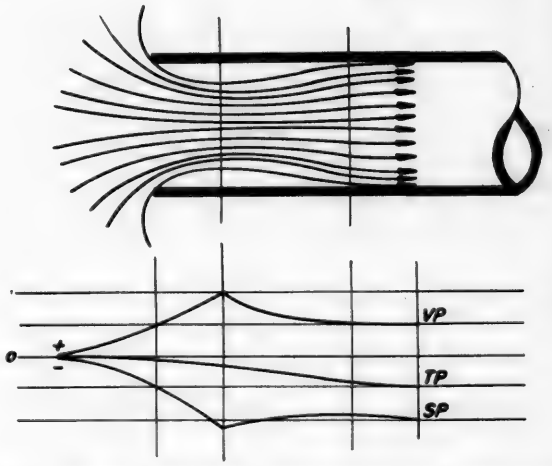


Fig. 1. The vena contracta at a suction opening. Courtesy Committee on Industrial Ventilation.

Measurement of air flow into or out of openings such as duct ends, grilles, hoods, and doorways requires careful technique. The vena contracta (Fig. 1) is always present and care must be taken to measure the air velocity in the plane of the opening, in order to avoid errors introduced by measurements in the vena contracta. The velocity is higher in the vena contracta than in the plane of the opening, and the flow cross-section is unknown except for certain simple and well-defined shapes such as sharp-edged orifices. At grille openings, if the velocity is measured at the openings of the grille, the free area of the grille should be used in flow computations, not the total area. If the sensing area of the instrument is large compared to the grille openings, correction factors are required. If accurate volume rate of flow is desired, much better results are obtained by measurements in the duct where the flow pattern and cross-section are usually more well defined.

In the case of suction openings, there are additional reasons for care in making measurements exactly in the plane of the opening. The air velocity outside of the open-

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ing varies inversely with the square of the distance from the opening, and flows from all unconfined directions toward the hood opening, not just along the axis of the hood. Thus measurements made in front of the hood face can be in error in both magnitude and direction. Inside the hood face, in addition to the questionable area of the vena contracta cross-section, the static pressure is below that outside. Many air flow instruments, including some of those most popular for field measurements in industrial hygiene, depend on air flow through the instrument caused by a difference in static pressure at upstream and downstream ports. With this type of instrument, the static suction inside the hood face will cause errors in reading. Errors of this type become less important with increasing face area of the hood, and with decreasing face velocity; for large openings at low velocity, they may be negligible.

Air Flow in Confined Space

In a round pipe or duct under ideal flow conditions, the air velocity is highest at the center of the duct, and becomes less towards the sides of the duct, as shown by the flow profiles in Fig. 2; and the flow direction is a straight line parallel to the duct centerline. Since almost all practical applications of air flow involve only the turbulent region of flow, streamline flow will be omitted from this discussion. Although Fig. 2 shows the average velocity as about 0.8 times the centerline velocity and in general conform with other works on fluid flow, many authorities on air flow give this value as 0.90 or 0.91. It is recommended that centerline velocity readings not be used for quantitative work except in small ducts, as discussed later. If it is desired to use centerline readings as a quick reference value in a duct where the flow profile is already known, a factor relating the centerline to average velocity for that particular station may be developed.

The flow profile may be made close to ideal by following the standards of the National Association of Fan Manufacturers for rating fans, where 7½ duct diameters of straight pipe with straightening vanes is provided upstream of the measuring station. In most cases in the field, a straight section of pipe from 5 to 7 diameters long, free from any branch entries, elbows, dampers, or other flow-disturbing obstructions, usually provides a satisfactory location for flow measurement.

Unfortunately, ductwork installations are usually designed to fit into a cramped space, or to miss columns and beams, rather than to provide a nice straight section of pipe for velocity measurement purposes. The disturbances to air flow resulting from various fittings, and most likely to result in errors, are of two kinds; distorted flow profile, and vortex or "rotating" air flow.

Correct determination of distorted flow profile requires a number of measurements to establish the average velocity through the flow cross-section. For round ducts, the ten-point traverse has been developed, with measurement points as shown in Fig. 3. The round cross-section of the

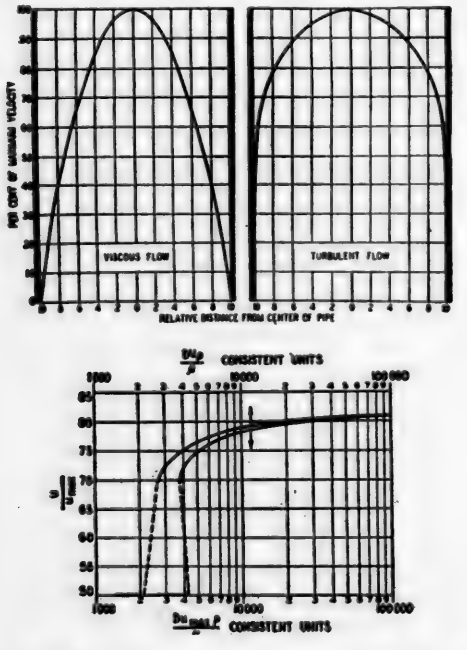


Fig. 2. Ideal flow profile, after Badger and McCabe, Elements of Chemical Engineering, McGraw-Hill, New York, 1936.

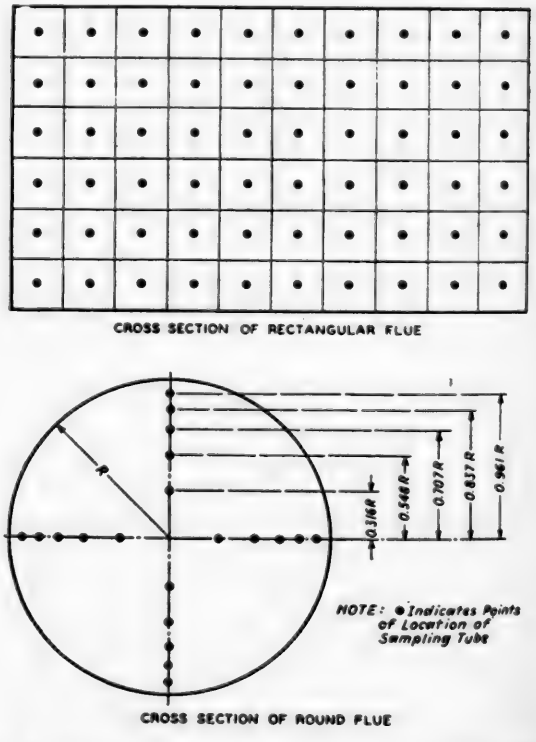


Fig. 3. Location of traverse points, after Marks, Trans. ASME, Nov. 1936.

TABLE 1—DISTANCE FROM WALL OF ROUND PIPE TO TRAVERSE POINT FOR VELOCITY READING
(For 10-Point Traverse)

Reading No.	% of Diam.	Pipe Diameter, Inches																						
		4	4½	5	5½	6	7	8	9	10	11	12	14	16	18	20	22	24	26	28	30	32	34	36
		Distance from Wall to Traverse Point, Inches																						
R_1	2.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7
R_2	8.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.6	1.8	2.0	2.1	2.3	2.5	2.6	2.8	3.0
R_3	14.6	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.3	1.5	1.6	1.8	2.0	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.2
R_4	22.6	0.9	1.0	1.1	1.2	1.4	1.6	1.8	2.0	2.3	2.5	2.7	3.2	3.6	4.1	4.5	5.0	5.4	5.9	6.3	6.8	7.2	7.7	8.1
R_5	34.2	1.4	1.5	1.7	1.9	2.0	2.4	2.7	3.1	3.4	3.8	4.1	4.8	5.5	6.2	6.8	7.5	8.2	8.9	9.6	10.3	10.9	11.6	12.3
R_6	65.8	2.6	3.0	3.3	3.6	3.9	4.6	5.3	5.9	6.6	7.2	7.9	9.2	10.5	11.8	13.2	14.5	15.8	17.1	18.4	19.7	21.0	22.4	23.7
R_7	77.4	3.1	3.5	3.9	4.3	4.6	5.4	6.2	7.0	7.7	8.5	9.3	10.8	12.4	13.9	15.5	17.0	18.6	20.1	21.6	23.2	24.8	26.3	27.8
R_8	85.4	3.4	3.8	4.3	4.7	5.1	6.0	6.8	7.7	8.5	9.4	10.2	12.0	13.7	15.4	17.1	18.8	20.5	22.2	23.9	25.6	27.3	29.0	30.7
R_9	91.8	3.7	4.1	4.6	5.0	5.5	6.4	7.3	8.3	9.2	10.1	11.0	12.9	14.7	16.5	18.4	20.2	22.0	23.8	25.7	27.5	29.4	31.2	33.0
R_{10}	98.0	3.9	4.4	4.9	5.4	5.9	6.9	7.8	8.8	9.8	10.8	11.8	13.7	15.7	17.6	19.6	21.6	23.5	25.4	27.4	29.4	31.4	33.3	35.3

duct is divided into five annular spaces of equal area, with the outer annulus adjusted to compensate for viscous flow in the boundary layer. Thus velocities measured in each zone do not require weighting with respect to area represented but may be arithmetically averaged. Table 1 has been developed for quick reference in determining the distance inward from one side wall of the duct for each measurement point. If for example a pitot tube or like probe-type instrument is used, the tube can be marked off in inches from the sensing element, and inserted the proper distance for each reading of the ten-point traverse, according to the diameter of the duct. A ten-point traverse of velocity readings in two directions at right angles to each other will be more accurate and less subject to error that would arise if the flow profile were close to ideal in one plane but far from ideal in another.

For square or rectangular duct, a traverse should be made along at least three lines, at three points on each line, so that the centers of at least nine hypothetical squares or rectangles of equal area are the points of measurement. Some standards require a minimum of sixteen points; of course the more points, the more accurate the results. It is thus more efficient to drill the probe holes in the narrow side of a rectangular duct, since more traverse points may be obtained with fewer holes.

Some investigators recommend the use of center-line velocity readings, five-point or six-point velocity traverses, etc., in the interests of simplifying the work and saving time. However, the time and effort required to select the measuring station, drill the proper holes, and prepare the pitot tube and draft gage (or other instrument) is large in comparison with taking the actual velocity or velocity pressure readings; and it would appear that the increased certainty and accuracy obtained by the ten-point traverse fully justifies the small additional expenditure of time. The main exception is that concerning small diameter ducts of three or four inches or smaller, where most instruments such as a standard pitot tube are large enough in comparison with the size of the duct to make location of the traverse points difficult or ridiculous; in this case centerline readings are recommended. Fortunately in small diameter ducts, it is quite likely that a measuring station 7½ or more diameters downstream from the nearest flow-disturbing fitting will be found, and thus it is usually practical to select a station where the flow profile is close to ideal and centerline readings will give sufficiently accurate data.

Errors caused by vortex flow are more difficult to correct. Vortex flow may be caused by any device or combination of devices which impart a rotating or spinning component to the air stream, such that air describes a helical path in proceeding down the duct. Examples of fittings that create such flow are: two elbows in series, close to each other but in different planes; the exit duct from a cyclone dust collector without straightening vanes; the exit duct from a tubeaxial fan; the discharge duct from a centrifugal fan if provided with an elbow not in the plane of the fan wheel, etc. If vortex flow is present, it can be eliminated by installing straightening vanes, an egg-crate flow straightener, or similar device. Such devices are more suitable for laboratory or special set-up use than for field measurements, since they require dismantling and revision of the duct, and add resistance to the flow of air through the system. The more practical point of view is to avoid, if possible, a measuring station where vortex flow is likely to be an important factor.

Where distorted flow profiles cannot be avoided, close estimates may be made by ten-point traverses in two or more directions. Where vortex flow cannot be avoided, an estimate of the angle of the vortex with respect to the centerline of the duct can be made by use of directional velocity instruments, or if the location can be made visible, by thread streamers. The component of velocity in the forward direction parallel to the centerline can then be estimated by the function

$$V = V_m \cos \theta$$

where V = velocity component parallel to centerline
V_m = measured velocity in true direction of flow
θ = angle of vortex with respect to center line

Volume flow estimates using this method have, in the field, checked within 10% of that obtained by a reliable pitot traverse.

In many cases it is desired to measure the total flow of air in a ductwork system, but no location in the main duct can be found which does not involve severe question as to badly distorted flow profile or vortex flow. In such cases it is frequently possible to measure the velocity in the sub-mains or branches with greater confidence, and to obtain the total by addition of the parts.

The Pitot Tube

The pitot tube is one of the oldest instruments for measuring air flow, and one of the best in many respects. It operates on the principle of measuring the total or impact pressure of the air stream, and automatically subtracting the static pressure, leaving as a net reading the velocity pressure. The velocity pressure may be easily converted

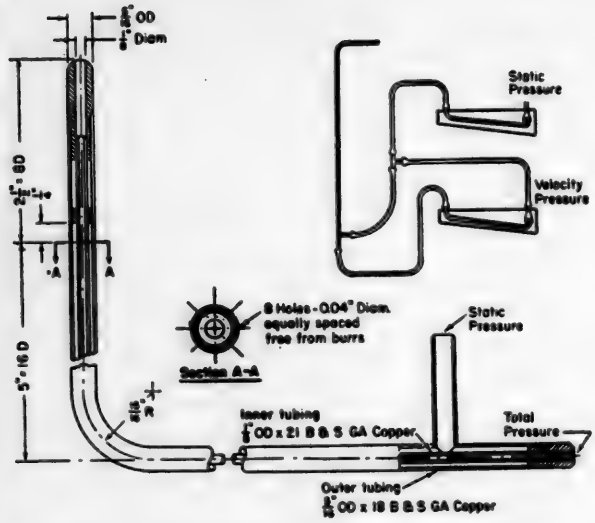


Fig. 4. Standard Pitot tube. Courtesy ASHVE.

to velocity, with suitable corrections for air density if necessary. The pitot tube is made according to several standards and modifications thereof but fortunately the nature of the instrument is such that these variations are insignificant in effect for practical purposes in industrial hygiene. Any of the standard pitot tubes may be used with confidence and without calibration. A standard pitot tube and method of connecting it to inclined manometers is shown in Fig. 4. It is unfortunate that the material of construction was specified as part of the standard for this instrument, since any material possessing dimensional stability (most metals, glass, etc., depending on the application) is perfectly satisfactory.

The pitot tube measures the velocity head directly, but in units of head of water (inches w.g.). By substitution of units for standard air (dry air at 70 F, 29.92 inches Hg barometer, 0.075 lb per cu ft density) in the basic gravitational expression $v = \sqrt{2gh}$, and by separating out terms correcting for the variable density of air, a resulting useful expression is

$$V = 4005 \sqrt{VP} \times \sqrt{\frac{0.075}{d}}$$

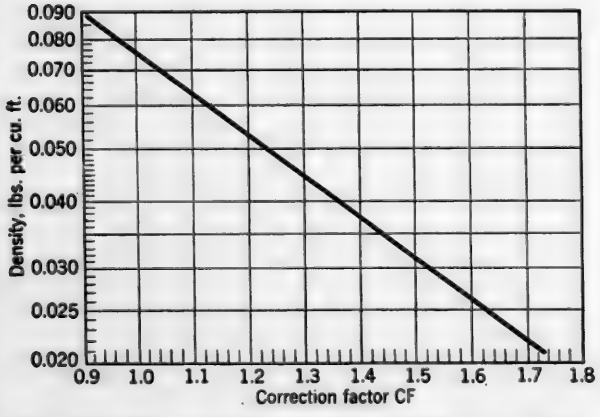


Fig. 5. Density correction factor for velocity head meters.

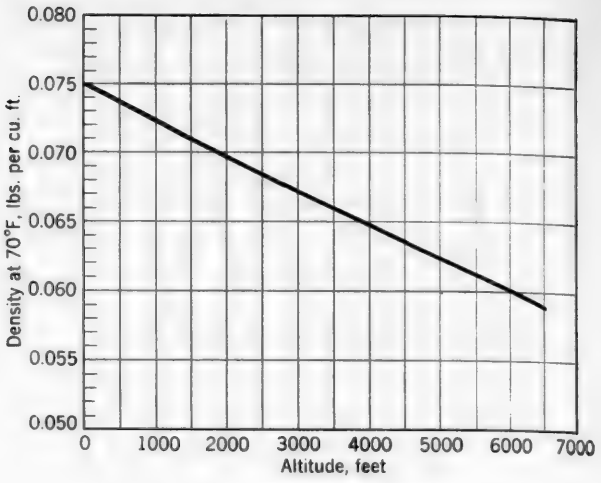


Fig. 6. Density of air vs. altitude.

where V = velocity, feet per minute
VP = measured velocity pressure inches w.g.
d = density of air at measured VP, lb per cu ft.

The term $\sqrt{\frac{0.075}{d}}$, called CF (correction factor), has been plotted with respect to d in Fig. 5.

The density of air varies, of course, with the temperature, pressure (and hence with altitude) and humidity. The variations in pressure caused by daily changes in barometric pressure or by the normal suctions and pressures up to 10 or 15 inches w.g. encountered in ductwork are usually ignored as negligible.

Considerable information is available concerning the density of moist air, and the subject is sufficiently complicated so that if exactitude is required reference should be made to special works on the subject. For most work, however, the application of the gas laws

$$d = 0.075 \times \frac{530}{460 + t} \times \frac{B}{29.92}$$

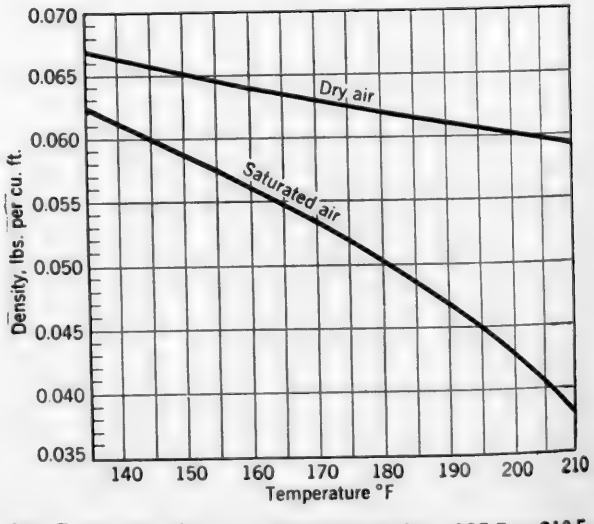


Fig. 7. Density of dry and saturated air from 135 F to 210 F.

where t = temperature, F,
B = pressure, inches Hg abs.

and standard psychrometric charts will be sufficient. For convenience, Fig. 6 presents the density of air at various altitudes. Fig. 7 presents the density of dry and saturated air from 135F to 210F, a region not covered by easily available psychrometric charts. To obtain the density of partly saturated air from Fig. 7, proportional interpolation according to the relative humidity will be sufficiently accurate for most purposes.

The procedure for estimating the flow of air by a pitot tube traverse, then, is as follows:

(1) Determine the measured velocity pressure at the proper traverse points.
(2) Convert the velocity pressure readings to velocity by reference to Table 2 for standard air.
(3) Average the velocity values (not the velocity pressure values).
(4) Determine the density of the air from preceding equations or curves.

TABLE 2—VELOCITY PRESSURE READINGS CONVERTED TO VELOCITY
VP = Velocity pressure, inches w.g.; V = velocity, fpm

VP	*V*	*VP*	*V*	*VP*	*V*	*VP*	*V*	*VP*	*V*	*VP*	*V*
0.06	981	0.43	2626	0.80	3582	1.17	4332	1.54	4970	1.91	5535
0.07	1060	0.44	2656	0.81	3604	1.18	4350	1.55	4986	1.92	5550
0.08	1133	0.45	2687	0.82	3625	1.19	4368	1.56	5002	1.93	5564
0.09	1201	0.46	2716	0.83	3657	1.20	4386	1.57	5018	1.94	5579
0.10	1266	0.47	2746	0.84	3669	1.21	4405	1.58	5034	1.95	5593
0.11	1328	0.48	2775	0.85	3690	1.22	4423	1.59	5050	1.96	5608
0.12	1387	0.49	2804	0.86	3709	1.23	4442	1.60	5066	1.97	5623
0.13	1444	0.50	2832	0.87	3729	1.24	4460	1.61	5082	1.98	5637
0.14	1498	0.51	2860	0.88	3758	1.25	4478	1.62	5098	1.99	5651
0.15	1551	0.52	2888	0.89	3779	1.26	4495	1.63	5114	2.00	5664
0.16	1602	0.53	2916	0.90	3800	1.27	4513	1.64	5129	2.01	5678
0.17	1651	0.54	2943	0.91	3821	1.28	4531	1.65	5144	2.02	5692
0.18	1699	0.55	2970	0.92	3842	1.29	4549	1.66	5160	2.03	5706
0.19	1746	0.56	2997	0.93	3863	1.30	4566	1.67	5175	2.04	5720
0.20	1791	0.57	3024	0.94	3884	1.31	4583	1.68	5191	2.05	5734
0.21	1835	0.58	3050	0.95	3904	1.32	4601	1.69	5206	2.06	5748
0.22	1879	0.59	3076	0.96	3924	1.33	4619	1.70	5222	2.07	5762
0.23	1921	0.60	3102	0.97	3945	1.34	4636	1.71	5237	2.08	5776
0.24	1962	0.61	3127	0.98	3965	1.35	4653	1.72	5253	2.09	5790
0.25	2003	0.62	3153	0.99	3985	1.36	4671	1.73	5268	2.10	5804
0.26	2042	0.63	3179	1.00	4005	1.37	4688	1.74	5283	2.11	5817
0.27	2081	0.64	3204	1.01	4025	1.38	4705	1.75	5298	2.12	5831
0.28	2119	0.65	3229	1.02	4045	1.39	4722	1.76	5313	2.13	5845
0.29	2157	0.66	3254	1.03	4064	1.40	4739	1.77	5328	2.14	5859
0.30	2193	0.67	3279	1.04	4084	1.41	4756	1.78	5343	2.15	5872
0.31	2230	0.68	3303	1.05	4103	1.42	4773	1.79	5359	2.16	5886
0.32	2260	0.69	3327	1.06	4123	1.43	4790	1.80	5374	2.17	5899
0.33	2301	0.70	3351	1.07	4142	1.44	4806	1.81	5388	2.18	5913
0.34	2335	0.71	3375	1.08	4162	1.45	4823	1.82	5403	2.19	5927
0.35	2369	0.72	3398	1.09	4181	1.46	4840	1.83	5418	2.20	5940
0.36	2403	0.73	3422	1.10	4200	1.47	4856	1.84	5433	2.21	5954
0.37	2436	0.74	3445	1.11	4219	1.48	4873	1.85	5447	2.22	5967
0.38	2469	0.75	3468	1.12	4238	1.49	4889	1.86	5462	2.23	5981
0.39	2501	0.76	3491	1.13	4257	1.50	4905	1.87	5477	2.24	5994
0.40	2533	0.77	3514	1.14	4276	1.51	4921	1.88	5491	2.25	6008
0.41	2563	0.78	3537	1.15	4295	1.52	4938	1.89	5506		
0.42	2595	0.79	3560	1.16	4314	1.53	4954	1.90	5521		

(5) Determine the correction factor *CF* from Fig. 5.
(6) Multiply the average velocity by *CF* to obtain the true velocity.
(7) The true velocity in fpm multiplied by the cross-section area of the duct in square feet will give the actual flow of cfm at the temperature and pressure and humidity of the gas.
(8) If flow in standard cfm is desired, the gas laws must be applied to correct to standard conditions.

The same data presented for density corrections using the pitot tube will apply to any instrument in which the action depends on the square root of the velocity pressure.

The size and shape of the impact or total pressure opening is relatively non-critical, but the size and location of the static holes is critical. Pitot tubes may be made in sizes other than standard, but geometrical similarity with respect to size and location of the static holes should be maintained. The pitot tube gives substantially correct readings as long as the tube alignment is within 5° of the true direction of flow. This relative insensitivity to direction is an advantage in ordinary field use, but hinders the usefulness of the instrument if exact direction of flow is desired. The critical nature of the static holes, and the likelihood that they or the impact hole will become plugged with dust in a heavy dust stream, has led to the development of special forms of the pitot tube discussed later. The pitot is unsuitable for field use with ordinary inclined manometers or draft gages below the range of 600 to 1000 fpm, although in the laboratory it or its modifications have been used with special two-fluid manometers, etc. for as low as 50 to 100 fpm (Brandt and Steffy, Trans. ASHVE, 1946). As a practical disadvantage, a long pitot tube for traversing large diameter ductwork is awkward to transport, although a jointed tube developed by E. Vernon Hill and Co., Chicago, is fairly satisfactory.

On the other hand, the advantages of the pitot are exceptional if the air velocity is above 1000 fpm. A properly designed, properly used pitot tube requires no calibration or adjustment and therefore is not subject to errors of this type. As an instrument it is regarded for most purposes as a primary standard.

Various modifications of the pitot have been made, largely for either one of two purposes; to reduce the difficulties with plugging of the holes in heavy dust streams, or to increase the manometer readings obtained so as to make possible the measurement of lower velocities in the field. These may in general be called double pitot tubes, since they usually take the form of a relatively large impact opening facing upstream, and another such opening facing downstream, a typical example of which is shown in Fig. 8. Such tubes are useful also when thick-walled ducts such as boiler stacks make the insertion of the conventional tube difficult through any reasonable port. Double-pitot and other modifications should be calibrated under substantially the same conditions as they are to be used, a severe handicap for field work.

Fig. 8. One type of double-pitot tube. Courtesy Western Precipitation Corp.

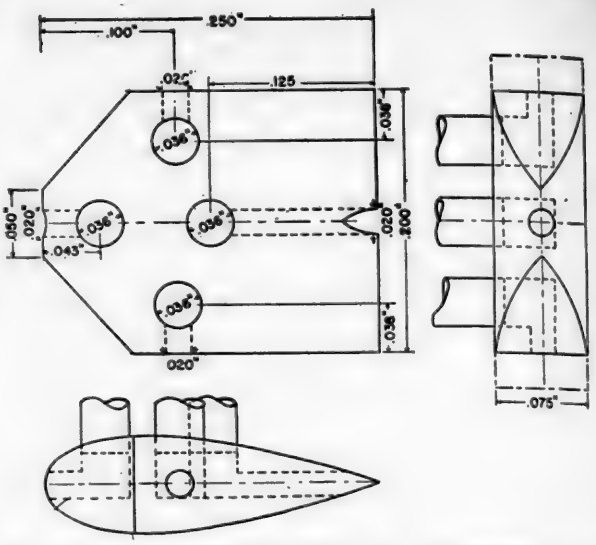


Fig. 9. Airfoil pitometer described by First and Silverman, Ind. and Eng. Chem., Feb., 1950.

A special form of the pitot called the airfoil pitometer (Fig. 9) has been developed. This improvement makes possible the more accurate determination of the true direction of flow to within less than 1°.

The Pitot-Venturi makes possible a larger differential manometer pressure for a given velocity of air flow. This modification yields manometer differentials varying from five times that obtained with the standard pitot at low velocities (1550 fpm) to ten times at high velocities (5000 fpm). The instrument is available commercially only in a single construction which has been previously calibrated, and is of considerable size (Fig. 10).

A somewhat similar instrument, the Air Speed Nozzle, also yields manometer differentials considerably higher than the pitot. At an air velocity of 4000 fpm, the differential is 6.7 inches w.g.; at 600 fpm, 0.15 inches w.g. (Fig. 11).

Rotating Vane Anemometers

The rotating vane anemometer is one of the old standbys of the ventilating engineer, and has a specific range of use

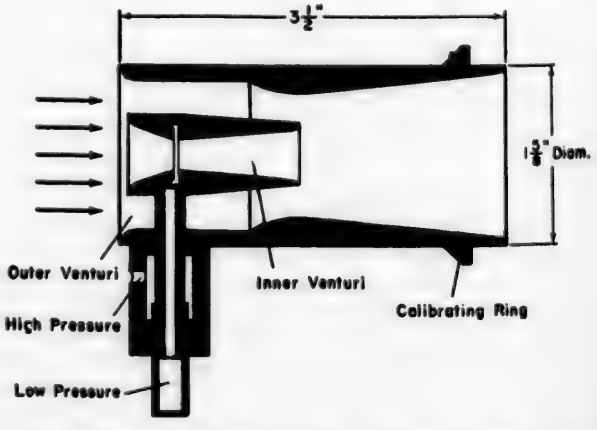


Fig. 10. Pitot-Venturi flow element described by Stoll, Trans. ASME, Oct., 1951.

for which it is excellent. It consists simply of a set of fan blades connected through a gear train to indicating dials. The instrument must, of course, be calibrated, and a calibration curve for standard air is furnished with each instrument. The sensing area of most anemometers is rather large, about three or four inches in diameter, which renders them unsuitable for measuring point velocities or the entry of narrow, slot-type hoods. Since the anemometer reading is taken over an appreciable length of time, such as one minute, the reading is the automatically integrated average velocity for the period, which is sometimes an advantage. Anemometers are jeweled-bearing instruments, and hence are subject to calibration and adjustment errors if exposed to rough handling, dust, or corrosive atmospheres. The range of velocity is from 30 to 10,000 fpm although this range is not available in a single instrument. A typical rotating vane anemometer is shown in Fig. 12. Correction factors for its use are given in manufacturers' directions.

Fig. 12. Rotating Vane Anemometer. Courtesy Taylor Instrument Co.

Swinging Vane Anemometer

The swinging vane anemometer is a very useful instrument, suitable for a wide variety of applications. The pressure of air flowing through the instrument deflects a swing vane or rotating windmill element against a loading spring, and the pointer movement reads directly in feet per minute. One model (Fig. 13) is provided with numerous fittings for various uses, such as measuring slot velocities. Although fairly rugged and suitable for field use, the instrument does require periodic calibration and adjustment. The various orifices furnished for different purposes are calibrated as a unit with the connecting tubing and on a specific instrument, and it is not safe to switch orifices from one instrument to another, or to change the type, size, or length of rubber tubing, without recalibration.

Since the swinging vane anemometer passes air through the instrument, the presence of dust, condensation, or corrosive atmosphere is troublesome. Various models can be provided with a filter to exclude dust, but this in itself is a source of error in that as the filter becomes plugged with dust, the resistance of the filter increases. The filter in use should be frequently checked against a new filter. The instrument, by means of special fittings, can be adapted to measurement of static pressure or can be used in place of a pitot tube; but the pitot tube is preferable where useable because it requires a smaller hole in the duct, is a primary standard, and is not subject to calibration or adjustment error.

The swinging vane anemometer can be obtained in ranges covering from 30 or 50 fpm to 10,000 fpm, and with all the special fittings available, is an instrument of wide practicality. Its use, however, demands careful at-

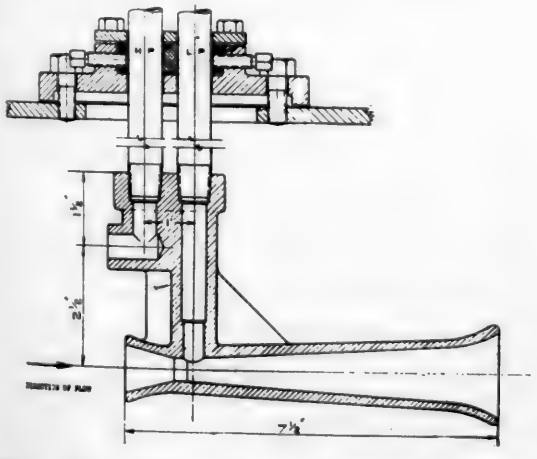


Fig. 11. Air Speed Nozzle. Courtesy Republic Flowmeters Co.

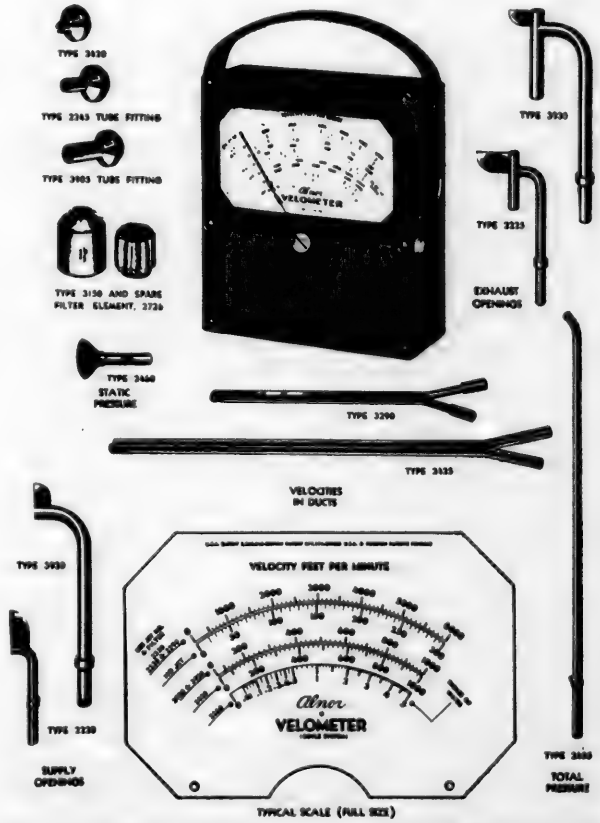


Fig. 13. Swinging Vane Anemometer. Courtesy Illinois Testing Laboratories.

Fig. 14. Typical heated thermocouple anemometer. Courtesy Hastings Instrument Co.

tention to technique and use of the fittings exactly as prescribed in the directions. Correction factors should be applied as described in the Industrial Ventilation Manual of the ACGIH (Edwards Bros., Ann Arbor, Mich., 1954).

Heat-Flow Anemometers

The overall heat-transfer coefficient at a solid-gas interface is a function of the gas velocity, and this basic phenomenon has been used in several ways to measure air velocity. The greater the air velocity, the more rapidly is heat removed from a heated wire, thermometer bulb, or other sensing element.

In the heated thermometer anemometer, a definite amount of current is passed through the heating element consisting of fine wire wound around one of a set of thermometers. The other thermometer is used to determine the dry-bulb temperature of the air. As usually furnished, this instrument is capable of measuring velocities from 10 to 6000 fpm, but it takes some time for thermometer temperatures to reach equilibrium at the lower velocities. It is non-directional. The glass thermometers make it somewhat fragile for field use and it is usually not calibrated for conditions far different from standard air. It is subject to radiation error.

The hot-wire anemometer depends on the variation of resistance of a wire with temperature. Current is passed through a resistance wire to heat it; the heat removal from the wire depends on the velocity and temperature of the air stream. Hence, the temperature of the wire and its resistance vary with the air velocity.

The heated-thermocouple anemometer is based on the same principle of increased heat removal from a heated wire due to increased air velocity. However, by the use of balancing circuits and thermocouple junctions, both hot and cold, errors due to ambient temperature changes or radiant heat sources can be made negligible although such errors were present in some early instruments of this type. The instruments are of fairly wide range, from 10 to 6000 fpm, and response is rapid. In general the small sensing area provides a non-directional point velocity reading, but directional probes are furnished with some models if desired. These instruments may be fitted with accessories enabling them to be used to measure static pressure or air flow in ductwork. It would appear, however, that they are most suitable for low air velocity, room air currents, hood openings, etc. The probes are subject to fouling by dust and corrosion. A typical instrument of this type is shown in Fig. 14.

The Kata thermometer is an instrument developed in conjunction with human comfort studies. It was the first widely-used instrument for measuring very low air velocities, and deserves mention mainly from a historical viewpoint. It consists of a glass bulb and stem similar to a thermometer, with two etched marks on the stem. The internal liquid is heated by immersing in hot water until it expands above the upper mark, the thermometer is then placed in the air stream, and the time noted for the liquid to fall from the upper to the lower mark. The instrument is fragile, suitable only for the lower velocity ranges, and is influenced by external heat and radiation sources (as it should be for comfort measurements).

Miscellaneous Methods

Almost any physical phenomena which vary with the velocity pressure of moving air, or with the increase in heat transfer with velocity, may be adapted to the measurement of air flow. Investigators who have developed special instruments for their own special problems are legion, and no attempt will be made to cover all such developments. Two examples will suffice.

Bloomfield and Silverman (AMA Arch. of Ind. Hyg. and Occup. Med., Nov. 1951) developed an instrument capable of measuring velocities as low as 50 fpm, called the Suction Soap Film Meter. A disc, provided with a small hole on the downstream side, is placed in the air stream normal to the direction of flow. The suction created at the hole on the downstream side of the disc moves a soap-bubble along a glass tube, the walls of which have been previously wetted with solution. Timing of the travel of the soap bubble yields an indication of the air velocity. Apparently the device is suitable only for measuring velocities in unconfined space, since no mention is made of arrangements for offsetting the effect of static suction or pressure in ductwork.

Since in the strict sense of the word velocity refers both to magnitude and direction, the V-wire direction probe developed by Nottage et al (Trans. ASHVE, 1952) is significant, in that it provides measurement of the direction of flow to within about 2°, and is suitable for velocities lower than can readily be measured with modifications of the pitot tube.

For various special purposes, or where standard instruments cannot be used or are not available, it is sometimes possible to estimate air flow by timing the travel of a smoke cloud; releasing a known quantity of gas (such as CO_2) and analyzing the air at some downstream point for gas content; etc. Such methods must always be tailored to the specific circumstances at hand.

Metering Air

Because air is a compressible fluid, its metering should take into account changes in pressure, or fluid density, across the metering element where such changes are significant. The flow of a fluid is generally regarded as non-

compressible, however, if the change in absolute pressure across the metering element is less than 10%. Since such is almost always the case in industrial hygiene work, the following discussion will be confined to the metering of non-compressible flow.

Orifice Meters

The orifice meter has been very widely used as a flow metering device and hence the pertinent literature is too voluminous to be completely reviewed in this paper. The current discussion will be confined to the type of orifice most widely used for metering air, the square-edged or sharp-edged orifice, with vena contracta taps.

A square edged orifice should meet the following criteria:

(1) The walls of the hole and the upstream surface of the orifice plate should meet squarely at right angles, with no radius or rounding of the edge.
(2) The area of the orifice opening should be known exactly.
(3) The orifice plate should be no thicker than 1/30 the pipe diameter, 1/8 of the orifice diameter, or 1/4 the distance from the pipe wall to the opening, whichever is the smaller. If for reasons of mechanical strength the orifice plate must be thicker, the orifice hole must be tapered at an included angle of 60° to 90°, with the smaller diameter upstream.
(4) The orifice hole should be reasonably well centered in the pipe.

The upstream pressure tap should be located from 0.75 to 2 pipe diameters upstream from the orifice, and its location is not critical; one pipe diameter is usually chosen. The location of the downstream pressure tap is more critical, and may be located according to the formula

$$L = 0.90\,D\left[1 - \left(\frac{d}{D}\right)^2\right]$$

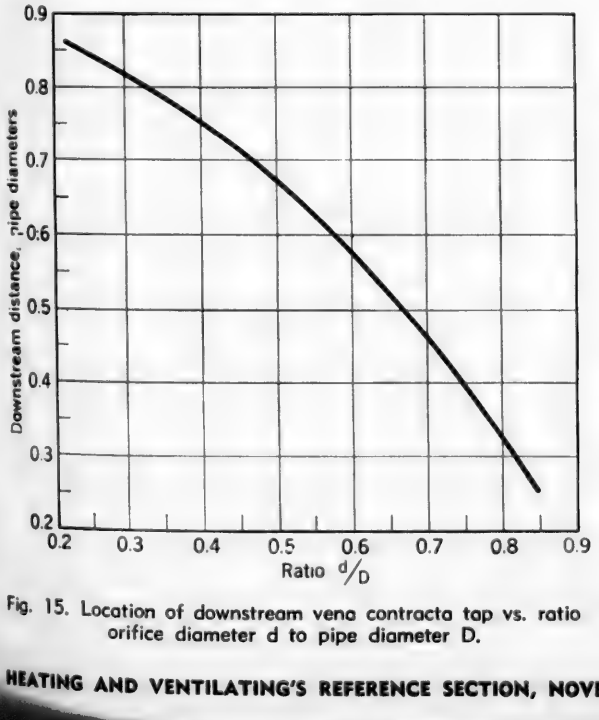


Fig. 15. Location of downstream vena contracta tap vs. ratio orifice diameter d to pipe diameter D.

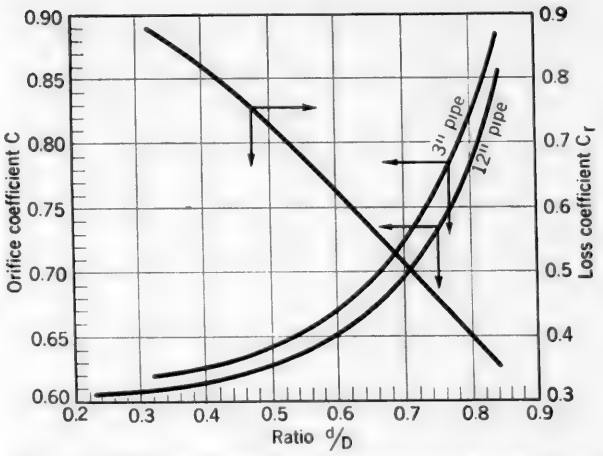


Fig. 16. Orifice coefficient C for vena contracta taps and permanent loss coefficient C_r vs. ratio of orifice diameter d to pipe diameter D.

where L = distance of tap from orifice, inches
D = pipe diameter, inches
d = orifice diameter, inches

or it may be located according to Fig. 15.

The basic equation relating the pressure differential across an orifice to the flow through it is $Q = CA\sqrt{2gh}$ where the coefficient C varies with Reynolds number, the ratio of the orifice diameter to the pipe diameter, the location of the pressure taps, upstream flow conditions, etc. For standard air at Reynolds numbers usually encountered in practice, the basic equation reduces to

$$Q = 4005\,CA\sqrt{p}$$

where Q = cubic feet of air per minute
C = orifice coefficient
A = area of orifice, sq ft
p = pressure differential of orifice taps, inches w.g.

The orifice coefficient C is presented in Fig. 16. Proportional interpolation may be used for pipe diameters between 3 inches and 12 inches, and the 12-inch values for larger pipe.

Corrections for air density, if different from standard air, may be made according to the data previously presented for use with the pitot tube, since the form of the basic governing relationship is essentially the same.

The presence of an orifice in a pipe line causes a resistance to flow and a loss in pressure of the flowing fluid which is, however, less than the pressure differential measured by the orifice taps. The phenomenon known as regain takes place as the high velocity vena contracta stream mixes with the slower-moving fluid in the downstream pipe. The total, or permanent loss in pressure is given by the equation

$$\triangle TP = C_r p$$

where $\triangle TP$ = permanent loss in total pressure, inches w.g.
C_r = coefficient
p = pressure differential of orifice taps, inches w.g.

Values of C_r are also plotted in Fig. 16.

The orifice meter may be used in almost any application where the resistance to flow caused by it is permissible, and where solids in the stream do not settle out against the orifice plate or erode the orifice. The main

TABLE 3—REQUIRED DISTANCE DOWNSTREAM FROM PIPE FITTINGS FOR METERING ORIFICES AND NOZZLES*

Fitting	Ratio d/D Orifice Dia. to Pipe Dia.	Distance, Upstream Fitting to Orifice		Distance, Vanes to Orifice	Distance to Next Downstream Fitting
		Without Straightening Vanes	With Straightening Vanes		
		Pipe Diameters			
90° elbow or tee	0.2	6			1
	0.4	6			
	0.6	8			
	0.8	20	10	8	2
Two 90° elbows in form of S	0.2	9			1
	0.4	9	8		
	0.6	14	10	6	
	0.8	25	16	10	2
Two 90° elbows in perpendicular planes	0.2	15	5.5	5	1
	0.4	18	6		
	0.6	25	8	6	
	0.8	40	12	6.5	2
Contraction or enlargement	0.2	4			
	0.4	6	Straightening vanes have no advantage.		
	0.6	9			
	0.8	15			
Gate valve 1/5 open	0.2	10	8	5	1
	0.4	12	8	5	
	0.6	48	9	6	
	0.8	over 60	15	9	2

*Chemical Engineers' Handbook, McGraw-Hill, N. Y., 1950.

limitation is the resistance, since there are many instances where the additional resistance is intolerable, or at least excessively wasteful of power. Otherwise, the orifice is a relatively inexpensive, easily reproducible meter, which if installed according to the standards developed for it, requires no calibration for ordinary accuracy. Accuracy within 2% can be obtained if the orifice is located sufficiently far downstream from flow-disturbing fittings as shown in Table 3. For ordinary work of less accuracy, the same considerations apply as for the pitot tube traverse.

In air work, orifices are frequently used at the discharge end of a pipe. For this type of installation, the formula

$$Q = 1096.5\, C_2 A_2 \sqrt{\frac{TP}{d}}$$

where Q = cubic feet of air per minute
C_2 = orifice coefficient
A_2 = area of orifice
TP = total (impact) pressure upstream of orifice, inches w.g.
d = air density lbs per cu ft

applies. The value of C_2 varies with the ratio of the orifice area A_2 to the pipe area A_1 as follows:

A_2/A_1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
C_2	0.601	0.609	0.618	0.636	0.656	0.682	0.708	0.730

A rapid method used by some authorities for determining the volume of air flow into an exhaust hood is also based on the principle of the orifice, using the duct end or exhaust hood at the inlet end of the duct as the orifice. Static holes are drilled in the side walls of the duct at a distance of from one to three diameters downstream from the throat of the hood, and the static suction is measured at this point. The volume flow is computed from the equation

$$Q = 4005\, C_3 A \sqrt{p_s}$$

where Q = volume flow, cubic feet per minute
C_3 = hood entry coefficient
A = cross-section area of duct, sq ft
p_s = static suction at point of measurement, inches w.g.

The value of entry coefficient C_3 may be obtained from any of the recent works on hood and ductwork design.

Flow Nozzles

A flow nozzle is an adaptation of the orifice in which the entrance is rounded so as to yield a higher coefficient, usually 0.97 to 0.99, because the contour of the nozzle closely approaches the contour of a vena contracta, thus minimizing turbulence and eddy losses. If used at the discharge from a plenum, or on an intake from room air so that the upstream velocity is negligible, the coefficient C may be taken as 0.99 and equation $Q = 4005\, CA\sqrt{p}$ applied. Flow nozzles in special commercial designs for insertion into pipe flanges are also available (Fig. 17) but are usually not used for large-volume air flows. The sheet-metal venturi is more practical for usual duct sizes.

Venturi Meters

The venturi meter is a streamlined restriction in the cross-section of the duct, resulting in a minimum of pressure loss and yet giving sufficient differential manometer readings for metering normal air flows. It is frequently used where the pressure loss of an orifice would be excessive, and is practical for permanent installation in ductwork. A design of venturi satisfactory for air flow work is shown in Fig. 18. The volume rate of flow for standard air may be estimated as follows:

$$Q = 4005\, C\, A_2 \sqrt{p} \sqrt{\frac{1}{1 - (A_2/A_1)^2}}$$

where Q = volume, cubic feet per minute
C = venturi coefficient
A_2 = area of venturi throat, sq ft
A_1 = area of upstream pipe, sq ft
p = differential pressure of venturi, inches w.g.

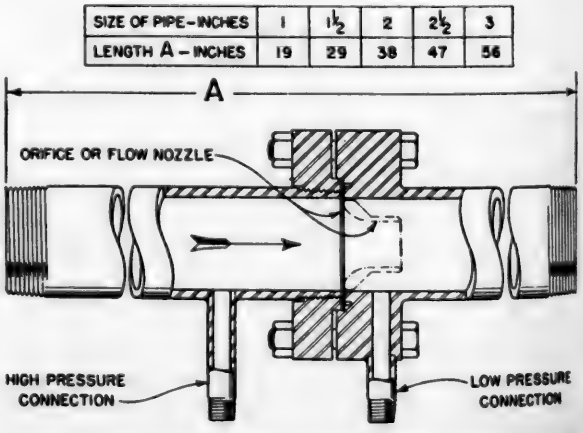

SIZE OF PIPE – INCHES | 1 | 1½ | 2 | 2½ | 3
LENGTH A – INCHES | 19 | 29 | 38 | 47 | 56
A
ORIFICE OR FLOW NOZZLE
HIGH PRESSURE CONNECTION
LOW PRESSURE CONNECTION

Fig. 17. Flow nozzle in pipe flanges. Courtesy Bailey Meter Co.

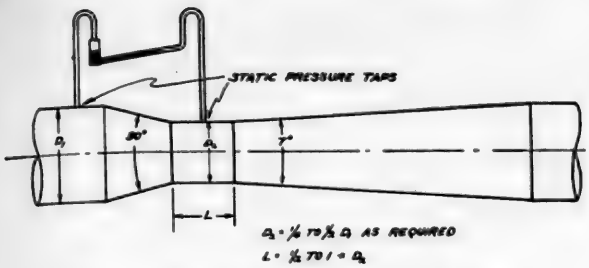


Fig. 18. Suggested design of Venturi tube.

The value of C for venturis constructed according to Fig. 18 is 0.98. For accurate work, the venturi should be calibrated under conditions of use. For convenience, Fig. 19 presents the value of the term $\sqrt{\frac{1}{1-(A_2/A_1)^2}}$ plotted against the ratio of areas. Commercial venturi meters are available in several designs with the static pressure ports integrally cast into the meter body in order to insure accuracy, but such meters are usually heavy and expensive for the usual ductwork application.

The permanent pressure loss of a venturi varies between 10% and 12% of the venturi differential, although some sources say it may be as much as 20%.

Wet Gas Meters

In industrial hygiene work, the use of wet gas meters is usually limited to the laboratory or for small flows of clean, water-insoluble gases. The meter consists of a series of inverted buckets or traps mounted radially around a shaft and partially immersed in water. The location of the entry and exit gas ports is such that the entering gas fills a bucket, displacing the water and causing the shaft to rotate due to the lifting action of the bucket full of air. The entrapped air is released at the upper portion of the rotation and the bucket again fills with water. For special cases oil may be used instead of water. Wet meters are available in sizes from 10 to 1200 cubic feet per hour of 0.64 sp. gr. gas at a pressure differential of 0.3 inches w.g. Accuracy is reported to be within 1%, and within 0.5 to 2% for large commercial meters handling up to 100,000 cubic feet per hour.

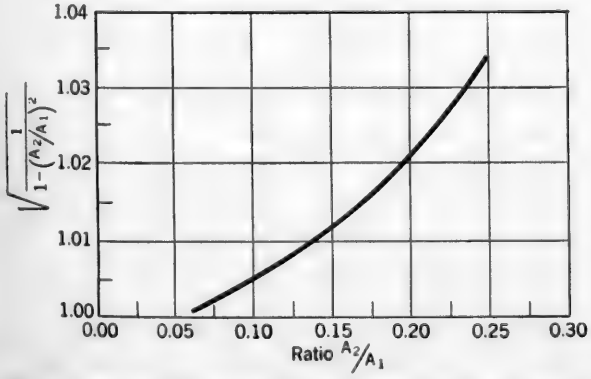


Fig. 19. Velocity of approach factor vs area ratio for venturi.

Dry Gas Meters

Dry gas meters may be used for metering flow of air or other clean gases. Again, in industrial hygiene they are usually used in the laboratory in sizes ranging from 20 to 1800 cubic feet per hour at 0.5 inch w.g. pressure loss. Commercial installations may be as large as 17,000 cubic feet per hour. Accuracy is usually within about 1%, but may become poorer with use and age. The metering action is that of a bellows or diaphragm pump in reverse. The gas flowing into one bellows chamber inflates it, actuating a set of dials and a set of slide valves which shunt the incoming flow to the other bellows.

Variable-Orifice Meters

Variable-orifice meters operate on the same principle as orifice meters, except that the area of the orifice is varied while the differential pressure is kept constant. A well known type is the Rotameter, made by Fischer and Porter Co. Gravitational pull on a bob or float provides the constant head; the motion of the float up or down a tapered tube provides the variable orifice area.

Rotameters are made in constructions which permit the metering of almost any relatively clean gas or liquid, no matter how corrosive, but they are subject to fouling from dust or condensate in dirty gas streams. In industrial hygiene, Rotameters are most frequently used in the laboratory or on sampling equipment since the size, weight, and expense of the meters is considerable for larger flows. Laboratory style Rotameters are available in size ranges from 5 cc per minute to 27 cfm; and commercial sizes are available up to 15,000 cfm. Rotameters are sometimes used as head meters across primary elements such as orifices in order to reduce the size meter required, and to extend the useful range of the orifice beyond that of ordinary manometers. This type of variable orifice meter is direct reading and places no special requirements on the piping upstream or downstream of the meter.

Rotary Gas Meters

Rotary gas meters of the type shown in Fig. 20 are widely used in process installations but apparently have

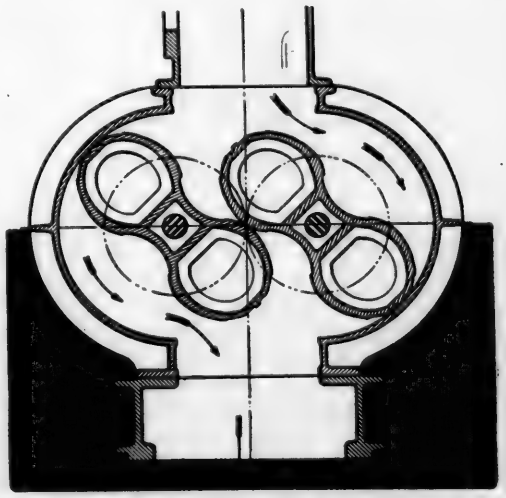


Fig. 20. Rotary gas meter. Courtesy Roots-Connerville Blower Co.

TABLE 4—CHARACTERISTICS OF AIR VELOCITY INSTRUMENTS

Instrument	Velocity Range, fpm	Portability	Directional?	Calibration Requirement	Ruggedness	Sensing Area Size	Range Temp. and Pressure	Dust & Fume Difficulty	Radiation Error	General Usefulness (1)	Remarks
Standard pitot	600 up	Fair	Yes	None	Good	Small area but long	Wide	Some	None	Good	
Double pitot	400? up	Fair	Yes	Once	Good	Small	Wide	Small	None	Special	
Airfoil pitometer	600 up	Fair	Highly	Once	Good	Small	Wide	Some	None	Special	Directional to 1°
Pitot-venturi	600? up	Poor	Yes	Once	Good	Large	Wide	Yes	None	Special	Magnified VP
Air speed nozzle	600? up	Poor	Yes	Once	Good	Large	Wide	Yes	None	Special	Magnified VP
Rotating vane anemometer	30-10,000	Good	Yes	Occasional	Poor	Large	Narrow	Yes	None	Fair	
Swing vane anemometer	30-10,000	Good	Yes	Occasional	Fair	Large; small for fittings	Medium	Yes	None	Good	Use filters for dust
Heated thermometer anemometer	10-6,000	Good	No	Once	Poor	Small	Narrow	Yes	Yes	Limited	Best for low velocity room air
Heated thermocouple anemometer	10-6,000	Good	Either	Occasional	Fair	Small	Medium	Yes	Slight	Good	
Kata thermometer	50-500	Good	No	Once	Poor	Large	Narrow	Yes	Yes	Limited	

(1) Author's opinion; and pertaining only to industrial hygiene.

TABLE 5—CHARACTERISTICS OF AIR FLOW METERS

Meter Type	Capacity Range cfm	Portability	Calibration Requirement	Restriction on Piping Location	Foul Gas Difficulty	Pressure Loss	General Usefulness(1)
Orifice	wide (4)	(2)	None	Yes	Low	High	Good
Flow nozzle	wide (4)	(2)	None	Yes	Low	Moderate	Fair
Venturi	wide (4)	(2)	None	Yes	Low	Low	Good
Wet gas meter	.05-20(3)	Fair	Once	No	Yes	0.3 in w.g.	Fair
Dry gas meter	.10-30(3)	Fair	Occasional	No	Yes	0.5 in w.g.	Fair
Rotameter	5 cc/m to 27 cfm(3)	Good	Once	No	Some	Moderate	Good
Rotary gas meter	10 up	Heavy	Once	No	Some	Moderate to high	Limited

(1) Author's opinion only; and pertaining only to use in industrial hygiene.
(2) Meters of this class are usually designed for a specific installation and have no portability requirement. In small sizes, as for sampling equipment, they are quite portable.
(3) Laboratory styles only. Commercial installations may be much larger.
(4) No upper limit. Lower limit imposed only by construction difficulties, and standard proportions are not used. Such meters require calibration.

not been used for industrial hygiene work to any extent, probably due to the size and weight of the equipment. Such meters are durable, of long life with high accuracy, and can handle almost any gas, even somewhat foul gases at high line pressures. They are available in sizes from 500 to 1,000,000 cubic feet per hour with accuracies usually well within 2%. However, even the smaller sizes weigh on the order of 200 pounds, and thus they are suitable only for laboratory or permanent installations.

Permanent Meters for Large Flow

There are many industrial exhaust or ventilating systems where the volume is checked frequently for various reasons. In such circumstances it would be time-saving to eliminate the necessity for instrument set-up, etc. for a pitot tube traverse or the like each time a fairly accurate determination of the volume was required. Two methods are suggested for rapid determination, with fair accuracy and low cost. One such arrangement would be a sheet-metal venturi section as previously discussed; and another would be a permanently installed impact-tube static port station, giving a differential pressure identical to the centerline velocity pressure as determined by pitot tube. Either of these arrangements could be calibrated by a careful pitot traverse.

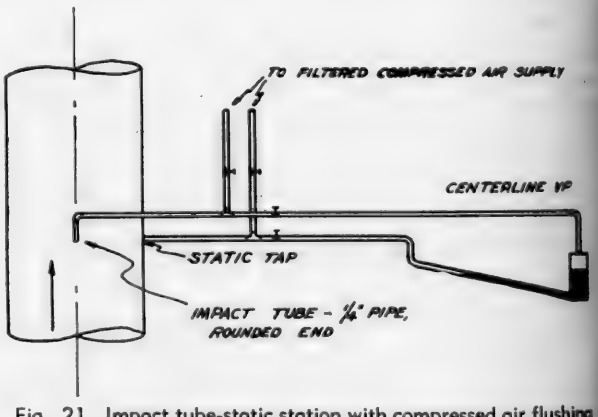
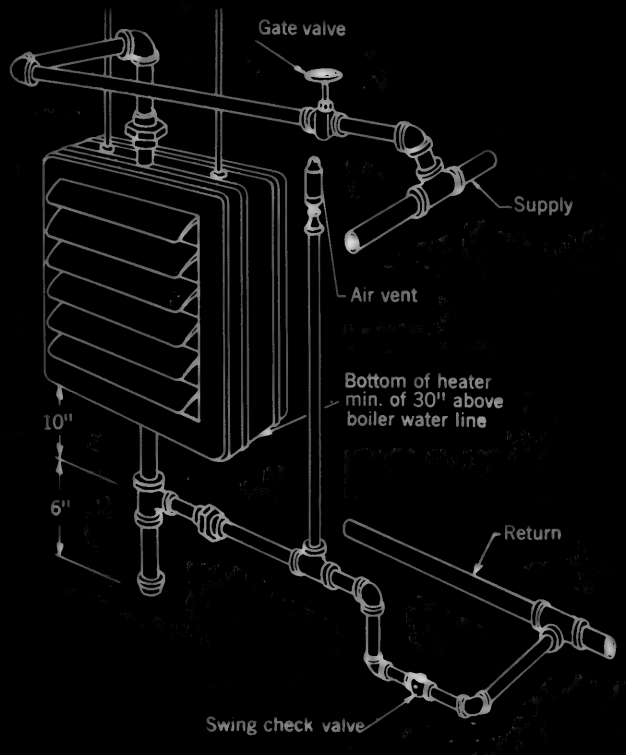


Fig. 21. Impact tube-static station with compressed air flushing connections.

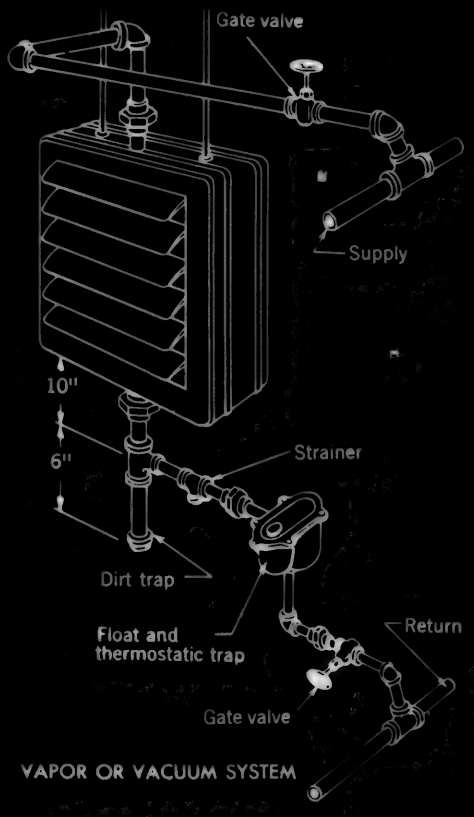
Eventual plugging of the pressure ports would result with either of such permanently installed methods, and accordingly a compressed air connection for flushing is suggested as shown in Fig. 21. More elaborate valving arrangements can be provided, if desired, to prevent accidental application of compressed air pressures to the draft gage.

Salient features and advantages and disadvantages of both air velocity instruments and air flow meters are summarized in Tables 4 and 5.

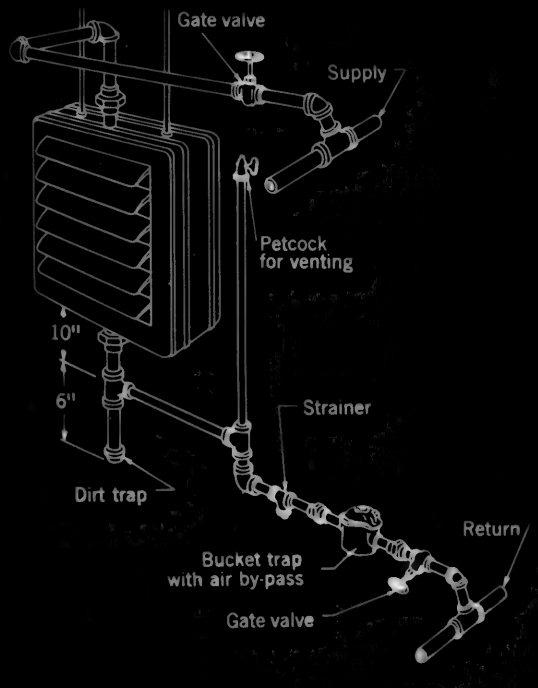
CONNECTIONS FOR UNIT HEATERS



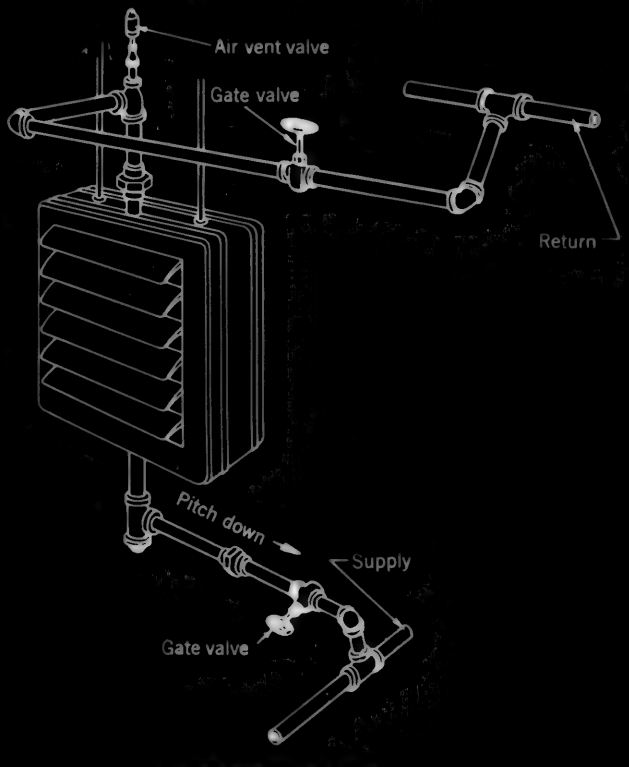
LOW PRESSURE GRAVITY SYSTEM



VAPOR OR VACUUM SYSTEM



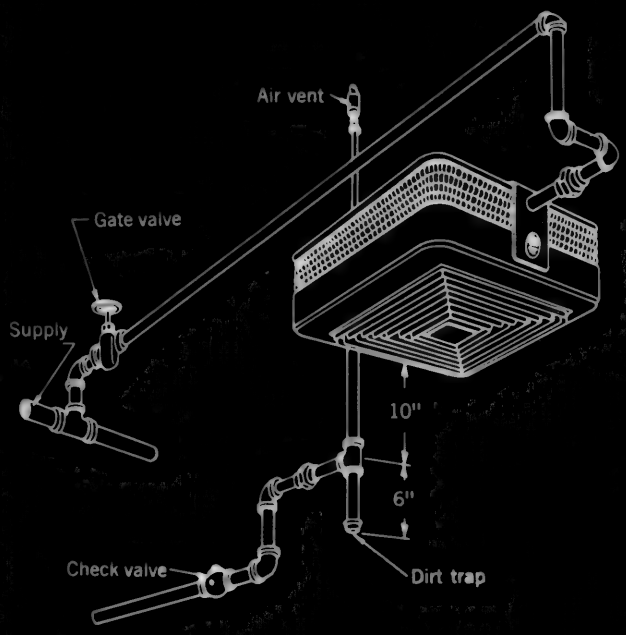
HIGH PRESSURE STEAM SYSTEM



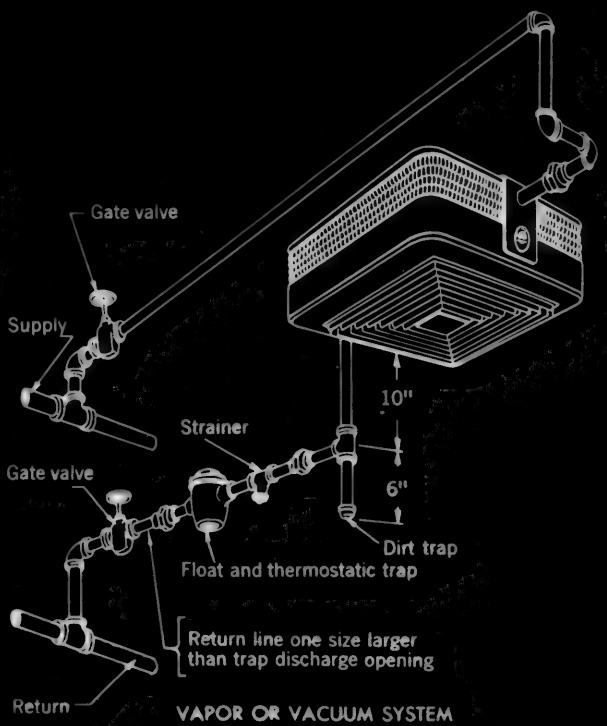
HOT WATER SYSTEM

HEATING AND VENTILATING'S DETAIL SHEET

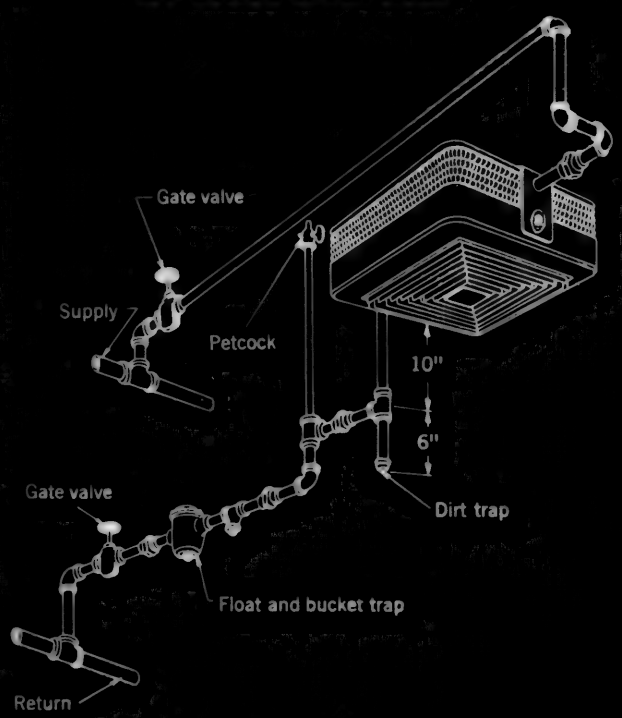
CONNECTIONS FOR UNIT HEATERS



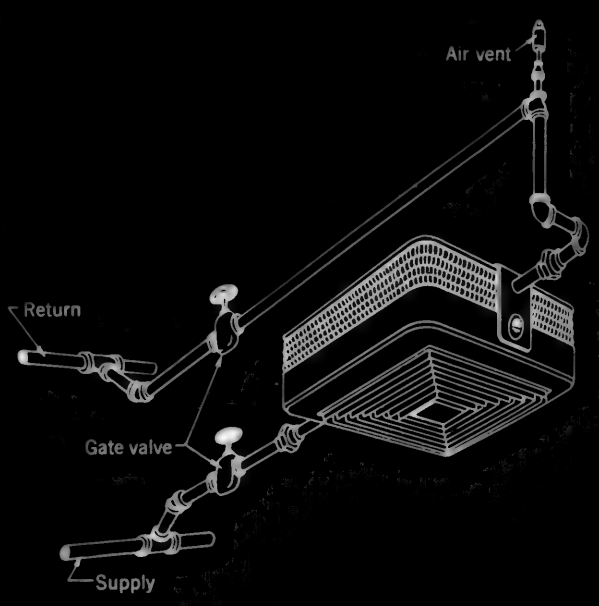
LOW PRESSURE GRAVITY SYSTEM



VAPOR OR VACUUM SYSTEM



HIGH PRESSURE STEAM SYSTEM



HOT WATER SYSTEM

FOR BEST OPERATION OF HORIZONTAL OR VERTICAL UNIT HEATERS WITH A HOT WATER SYSTEM, THE WATER FLOW MUST BE THE REVERSE OF NORMAL STEAM FLOW.

COURTESY, AMERICAN BLOWER CORP., DETROIT, MICH.

HEATING AND VENTILATING'S DETAIL SHEET

Fig. 1. In winter, top row of grilles supplies hot dry air across ceiling to eliminate condensation and rotting; in summer, bottom row of grilles supplies air for cooling.

Control of Water Vapor

JAMES MARSHALL

Consulting Engineer, Philadelphia, Pa.

Where large quantities of vapor are given off as part of an industrial process, there is the problem of how to make conditions comfortable for employees in the summer and how, during the winter, to prevent condensation on or within the structure.

MANY industrial operations are plagued with the problem of dissipating water vapor or free moisture forced into the plant atmosphere by high temperature or foced air driers. In using large and sometimes tremendous quantities of water as a carrying medium and for mixing and washing purposes, industrial plants ultimately face the problm of getting rid of this water from the finished product. Drying small mixes or pieces can sometimes be handled with centrifugal driers, but when drying products from a continuous process, it is preferable to dry by passing the product over a heated collender or through a forced hot air drier. Either the collender or the forced air driers drive the water off the product into the plant atmosphere.

Another source for putting large quantities of water into the atmosphere, is from high temperature baths used for washing, electro-plating, mixing and metal treating. These baths are usually large open tubs with the bath temperatures up to 210F. Water comes off in the form of vapor, but part of it may condense and give a mixture of free moisture and water vapor. When it is considered that for a bath temperature of 200F almost two pounds of water per hour may evaporate from a square foot of water surface, it can be seen that an electric plating tank measuring 3 ft wide by 50 ft long will evaporate 300 lb of water per hour.

These operations and processes which give off such large quantities of water have a capacity to elevate the humidity to a rather high degree for quite a bit of air. High humidity has two very undesirable results.

1. In summer it makes conditions very uncomfortable to employees.
2. In winter it causes troublesome condensation on the structure.

The conditions of comfort are quite obvious but condensation may not be until an expensive repair is necessary. Of course, condensation on the interior surface of the structure can be seen very readily, but the more insidious condition is condensation within the structure, inside the interor surface. It is this latter condensation which breaks down insulations, rots wood timbers, blisters exterior paint and causes mildew on interior paint.

Possibly Engineering Approaches

There are three possible engineering approaches open to the air conditioning engineer to ameliorate this high humidity condition:

1. The air can be dehumidified by refrigeration or by chemical absorbents.
2. The air water mixutre can be diluted through the introduction of more outside air.
3. The effect on occupancy comfort in summer can be ignored and the structure can be so constructed that deterioration of structural members is reduced to a minimum.

Refrigeration or chemical dehumidification equipment can be justified when one or more of the following conditions exist:

1. High concentration of occupants per cubic foot of space.
2. Controlled temperature or humidity improved the quality of the finished product.
3. Amount of moisture driven off from space is relatively low.
4. Building can be made practical for air conditioning at low cost.

When a ventilating fan and duct is used, the author is fond of the scheme illustrated in Fig. 1. This is installed in a package dye house where it was recognized that there would be a problem of worker comfort in summer and roof condensation in winter. There are two sets of outlets, one set at ceiling level and one set at the 9 ft level. In summer, the ceiling grilles are closed and 100 per cent fan capacity is delivered at 9 ft for high velocity air movement directed to a level of 5 ft from the floor. In winter the lower grilles are closed and full fan delivery comes from ceiling grilles. This air sweeps the ceiling to keep it dry. The system has fresh and return air dampers which are regulated from an electronic humidistat over the return air opening. As the humidity rises the fresh air dampers are opened, and vice versa. This system is equipped with air pre-heaters and filters as dirt could not be tolerated.

Another possible method of controlling the dampers with respect to the amount of outside air required to absorb the moisture can be accomplished by a control patented (No. 2,500,693) by the author for use in high moisture content rooms so that the roof could be protected against condensation. It consists of a hygrostat subjected to a sample of room air drawn through a duct of which one side is the roof and the other three sides are heavily insulated. As the room air passes through the duct, its contact with the cold roof lowers the dry bulb temperature so the air-vapor mixture approaches saturated humidity condition. On approaching 85 to 90 per cent relative humidity, the fresh air dampers are opened to introduce more fresh air to the room. Of course, this air would have its temperature elevated to 70 or 75F by preheaters.

Wall and Roof Construction

Wall and roof construction is the third way to combat the attack of fog and condensation from within. This approach calls for the use of insulation and vapor barriers on the interior of the wall or roof. These vapor barriers are applied on the warm side. However, it is the condensation that we cannot see that concerns us the most, the condensation within the structure that breaks down insulation, rots wood and causes spalling of masonry surfaces. It is not uncommon to hear of wood roofs insulated in the conventional manner rotting out within a year's time. In some instances, architects have used treated lumber to prevent rot only to have other problems because the lumber was treated with water soluble salts which dripped on everything when the condensation hit it.

On the surface this matter of applying insulation and vapor barriers may appear elementary. The truth of the matter is that it is often very difficult and sometimes impossible to get a tight vapor seal on an existing building due to the fitting and patching required around hangers, lights and beams. Even many new constructions have been unsatisfactory when finished because workmen and supervisors, and perhaps even engineers and architects, have not appreciated the importance of tight joints and careful application. Any cracks, holes or other openings in the vapor barrier can let the vapor or moisture penetrate within the wall where it condenses and begins to break down the insulating value of the material as wood, brick or insulation.

In the case of rectifying troubles in an existing building, the engineer will encounter tremendous resistance to the application of insulation and vapor barriers on the interior roof and walls. In the first place a contractor will charge more for applying on the interior of roofs because of scaffolding required, and the cutting and patching around pipes; the application to interior walls is difficult because of the many pipes and objects supported by the walls. In addition, the production manager usually does not want the mess inside nor does he want to shut down any equipment.

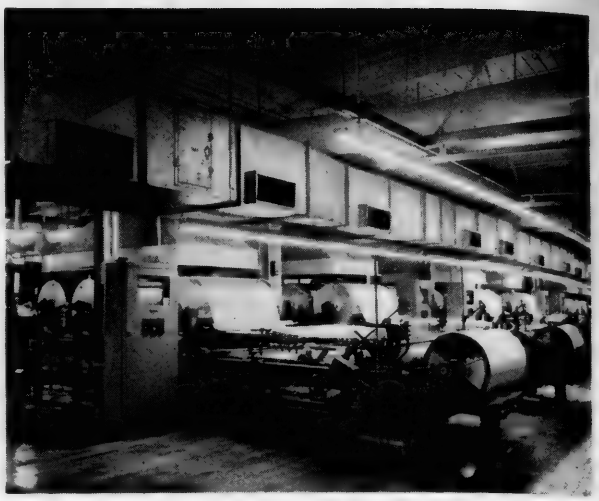


Fig. 2. Slasher room with exhaust hoods, and insulated roof. Ventilating duct supplies heated or cooled air.

Points for Consideration

In attempting to ameliorate condensation conditions and building deterioration by using insulations and vapor barriers, the engineer should not be satisfied just to select a construction which gives an acceptable U coefficient, without giving thought to the vapor barrier. After selecting a suitable type of construction, he should determine the maximum room dewpoint and minimum room dry bulb temperature coincident with the minimum outdoor temperature. With this information he should calculate the temperature drops through the various portions of the wall or roof and determine whether or not the temperature on the interior of the vapor seal is above the room dewpoint. Calculating the temperature drop through various constructions will show many interesting things not the least of which is that a thin wood deck with insulation is superior to a thick wood deck with insulation in keeping the temperature on the inside of the vapor seal above the room dewpoint. It can be readily seen that the less temperature drop that occurs between the room and the vapor seal the better.

Good engineering is correct application and it is not unusual to apply all of the discussed methods of dealing with condensation and vapor to a single room or space. Figure 2 shows a textile slasher room where the aqueous size solution is dried on the yarn by passing the yarn over steam heated cylinders. In this room the roof was insulated, the cylinders were hooded and connected to exhaust fans, and a supply air duct was installed to circulate cooled air directly toward the operators. All of these corrective steps made a comfortable room out of a bad situation.

James Marshall, at present a consulting engineer in Philadelphia, Pa., received his M.E. degree from the University of North Carolina in 1936. He has had 18 years experience in industrial air conditioning and has specialized in problems of air conditioning and insulation for all types of industrial operations including woodworking, printing, textiles, optics and electronics.

Conditions 3 and 4 would determine capaciy and hence first and operating costs; naturally the lower these are the more readily management will accept this equipment. Conditions 1 and 2 would be influenced by management's desire to improve labor relations and/or to improve the quality of the finished product. While it is the considered judgment of the author that the use of refrigeration or chemical dehumidification equipment is often overlooked as a sound engineering and economical solution to the problem, it will not be considered in detail. This article deals mainly with those processes where large quantities of water or vapor are given off by the process and where the number of occupants per cubic foot of space is so very low that it is difficult for management to substantiate the required investment.

Dilution of the air-water vapor mixture through the introduction of outside air and the exhausting of free moisture by fans is by far the commonest approach to the problem. It is not always the soundest approach either by engineering or economic standards, but it can be expedient and it can be cheapest in first cost.

Use of Wall Type Exhaust Fans

The simplest way to secure the air change and dilution is through the use of wall type exhaust fans strategically located to catch the vapors and moisture and to expel them outdoors. It is the easiest thing for a plant engineer to handle in that it merely requires the purchase of a fan or fans with motors and switches, and a simple installation and operating procedure. There is no complicated ductwork, or controls to install or filters to service. Generally speaking, rooms used for drying purposes are high heat gain rooms; the heat gain builds up from steam drums or boxes, heated air, large electric motors, large roof areas with ample roof and wall glass sash for natural ventilation. Because they are high temperature rooms, it is desirable to get as much air change to dissipate the heat. It must be said for the credit of exhaust fans that they move large quantities of air for a low cost per cfm both capital and operating cost.

There are several disadvantages to the use of wall type exhaust fans; not the least important one is the lack of control over the source of make-up air. If the make-up is from oudoors, it may introduce quality control problems from dirt, dust, bugs and other undesirable air contaminants. A second drawback to general air exhausting is the matter of lost heat. Since general air exhausting is inefficient, it depends on moving large quantities of air in order to be sure of removing the undesirable moisture. The monetary value of the steam required to heat the air removed by a large exhaust fan during a single winter, may be many times the cost of the fan. Of course this latter disadvantage is based on the assumption that the make-up air had to come from parts of the plant that required steam heat to keep acceptable conditions. This is not unusual as the drying room is usually just one step in a multiple operation.

The only application of general exhausting that is economically and engineeringly sound is where:

1. Dirty air is not objectionable from a quality control standpoint.
2. The process requires very little control of atmospheric conditions with respect to temperature and/or humidity.
3. A high air change in both summer and winter is desirable.

It might be argued that if a high air change in winter is costly, then some of the fans can be shut down or operated at low speed. In most cases this latter argument would not be sound as the decreased moisture removal in extreme cold weather could set up insidious condensation conditions not manifest until costly damage had been done.

Exhaust Hoods and Canopies

The use of exhaust hoods and canopies connected to fans through ducts tends to confine the vapor or moisture to a set path from source to outdoors. As a result of this confinement, more moisture or vapor can be expelled by handling far less air than is necessary in general exhausting. Good hood design can give very effective air velocities where they will do the most good, and as this velocity only needs to be maintained over a comparatively small area, the total volume to be moved may be as little as 15 to 25 per cent of what is required in the case of general exhausting. The advantages to this type exhausting are obvious.

The disadvantages to hoods are:

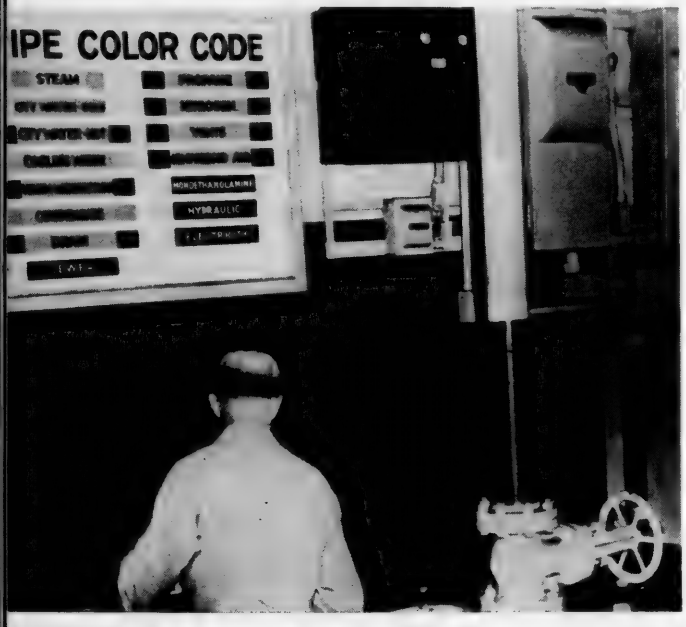
1. First cost, particularly where special metals are required.
2. Necessary ductwork which may be complicated and quite often impossible if overhead conveyors are used.
3. Less general air movement and consequently less comfort if the room is hot.

Disadvantage 3 can quite often be overcome by radiant shielding which of course is another expense as these shields are made with expensive metals. Radiant shielding is finding favor in many plants. Where a good job of shielding can be done without making it too difficult to tend the equipment, improvement in worker comfort is noticeable. Another advantage to shields is that it further helps to confine vapor and moisture driven off in the process. If radiant shielding is impractical because it is necessary to have continuous access to the bath or dryer, then the solution to disadvantage 3 is through the use of a supply air ventilating fan and ductwork. In the author's opinion, this is a far better solution to worker comfort in high heat gain rooms as the air velocity can be made quite high. Another advantage to a ventilating fan and duct is that air filters can be employed to assure a clean atmosphere. Of course heating, humidfying and cooling can be incorporated in a duct and this is becoming more and more important as industry understands the benefits from controlled conditions.

Don't be alarmed if you should pull into a southwest plains gas station after a long hot drive and the attendant pokes a wide flexible hose right into your car. Chrysler Airtemp's mobile, 3-hp, waterless air conditioner is used in this way to cool cars as a service to gasoline customers.

Preformed sections of cellular glass insulators by Pittsburgh Corning Corp., are applied around underground, steam-traced bunker C fuel oil supply lines for a new Con Edison plant in New York. Insulation sections were secured by strapping bands on nine-inch centers before application of the final coating.

Picture Paragraphs



(Above) Pipe color code board is one of the reasons why there has never been an accident due to mistaken identification of pipe lines or valves in 8 years of operation at the Continuous-Cast Products Department of American Smelting & Refining Co.

(Below) Unique fuels information center on wheels, the Coal-mobile, sponsored by Anthracite Information Bureau, is on a five-month doorstep tour of the northeastern seaboard to acquaint fuel consumers with developments in automatic hard coal heating.

(Below) Air at low relative humidities supplied by Surface Combustion Kathabar unit is used by research engineers at the Portland Cement Association laboratories to weather-test all types of concrete structures.

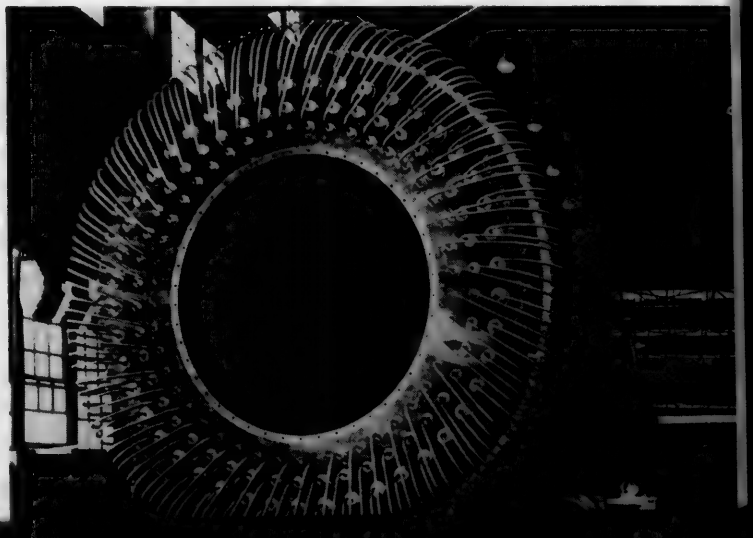
(Above) This gives some indication of the permanent snow blanket and typical building construction at Thule Air Force Base, Greenland. Orr & Sembower Powermaster boilers in groups of 3 and 4 units serve individual sections of this huge base.

(Above right) Part of the outside steam distribution system on the installation at Thule Air Force Base.

(Right) Shown in one of the boiler rooms at Thule are, l. to r., David D. Gough, electrical control maintenance; John G. Pable, plant operator; Robert Shaffer, steam maintenance; Fenton Tollerson, heating supervisor; and Ernest C. Cole, Orr & Sembower's Powermaster technical representative.

(Below) Research engineers at General Electric's Thomson Lab prescribe milk of magnesia as the best tonic for keeping furnace nuts and bolts turnable. Here, an engineer is applying it to clamping bolts before running a test.

(Below) Mammoth, 100 x 10 ft. steam tube dryer, with all-aluminum interior, shown during construction at shops of General American Transportation Corp., is one of the largest ever built. Aluminum Company of America supplied engineering assistance and 35,000 pounds of aluminum for the massive project. There are 23,700 square feet of heating surface in the aluminum steam tubes, which, together with the other pressure parts, are of adequate strength for 200 psig steam pressure.



How Much Can a Pump Deliver?

R. A. MILLER

Application Engineer, Centrifugal Pump Section, Allis-Chalmers Manufacturing Company

A discussion of the use of a pump's limiting entering head as a means to minimize difficulties experienced in establishing pump capacity or volume. Four examples are given for determining the available LEH.

IF you have experienced difficulty in expressing a pump's limitation in terms of net positive suction head (NPSH), perhaps the designation "limiting entering head" (LEH) may serve as a solution.

A pump can pump out only as much as it can receive. Limiting entering head is the measure for determining how much pumpable material can enter a pump independent of its ability to produce discharge head or pressure.

The new designation is original with Allis-Chalmers and is being used to minimize difficulties experienced up to now in distinguishing between net positive suction head and the suction head itself. The suction head can be read on a gauge at the inlet of the pump after the pump is primed but before it is operating. Limiting entering head cannot be read on a gage, except in rare instances, but must be calculated.

Limiting Entering Head

The limiting entering head limits a pump's capacity or volume. The rpm and impeller diameter limit the head or pressure produced. In every pumping problem there are two LEH consideration: (1) the required LEH of the pump and (2) the available LEH of the site.

The work of pumping a fluid by displacement or by centrifugal force causes a lowered pressure at the pump inlet. New fluid will flow into this low pressure area if there is sufficient external force available to push it into this space as fast as it is being displaced. The measure of this required force is the LEH of the pump.

A pump cannot operate on a liquid until the liquid enters the pump. LEH is the measure by which it is determined how much liquid can enter the pump. Formula:

Let Q = volume of gpm, cu ft
A = inlet area of the pump, sq ft
V = velocity of the fluid, ft per min
K = the pump designer's coefficient

Then $Q = AVK$

Since $V = \sqrt{2gh}$, then by substitution $Q = A\sqrt{2gh} \times K$ where K = a constant for a given pump.

For a given size pump, the inlet area *A* is fixed and is a constant; 2g also is a constant, with g = pull of gravity (32.2 ft per sec per sec).

Therefore, *Q* varies with *h* and H = LEH

Stated another way, *H* is the head of external force required to cause the desired volume *Q* to flow into the pump. Conversely, if *H* is fixed, it is the LEH, since it limits the quantity that can flow into the pump.

The formula is theoretical and does not apply in actual practice due to design variations. Values must be determined from actual test. All pump curves have LEH (NPSH) designations plotted against volume in gpm. Therefore, it is unnecessary to calculate velocities or areas. Just match the pump requirement with the available LEH. Be sure to have a little more LEH available than the minimum pump LEH requirement.

Rudolph A. Miller, an application engineer in Allis-Chalmers centrifugal pump section, joined the company in 1927 as a student on the firm's cooperative course while attending Marquette University. He received his mechanical engineering degree from Marquette in 1930.

Mr. Miller was employed in the company's blower and condenser, and steam turbine sections, respectively, for 13 years before being named to his present post in the centrifugal pump section in 1948.

He is a licensed Wisconsin professional engineer, and the inventor of a common expansion tank and water heater.

Available LEH of the Installation Site

Determine the elevation H_E of the pump center line above or below the surface of the liquid in feet.

Determine the absolute pressure P_A above the surface of the liquid converted to feet.

Determine the internal vapor pressure P_V of the liquid due to temperature converted to feet.

$$\frac{\text{PSI} \times 2.31}{\text{Specific Gravity}} = \text{feet}$$

Then the available LEH = $(P_A - P_v) \pm H_E - H_F$

Where H_F = friction of suction piping, valves, screens, etc. in feet.

This formula determines the difference in pressure between the state of the liquid and its boiling point, measured at the pump center line. It is known that when a liquid reaches the saturation point (boiling point), any further addition of heat or *reduction* in pressure will cause the liquid to vaporize.

It was stated earlier that a pump *reduces* pressure at the inlet due to the pumping action. LEH is the measure or limit to which the pump can be permitted to reduce the pressure without vaporizing the liquid.

After determining the installation limitation or available LEH, a pump can be selected to suit. Very often the installation LEH is very low as with condensate pumps. Then, of necessity, a pump must be selected with a large inlet area, although it may operate at considerably less than the maximum efficient point of that pump.

If the inlet area of a pump is increased in order to satisfy a low LEH condition, some efficiency will be lost. This results in a greater horsepower requirement. There

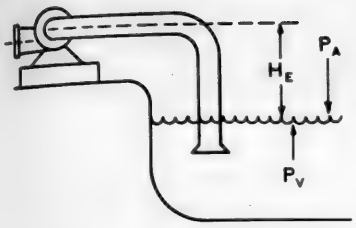


Fig. 1. Installation to pump water from a river or reservoir.

exists a definite optimum relationship between inlet area, width and diameter of an impeller to produce maximum efficiency. It is often economical to change the installation LEH to permit use of a more efficient and perhaps a less expensive pump.

Be sure at all times that the installation LEH is greater than the pump requirement and that sufficient margin is allowed for sudden changes in the pressure on the surface of the liquid.

Examples

Four examples are given to show how LEH is obtained.

Figure 1 shows an installation to pump water from a river, lake or reservoir at approximately sea level or P_A 34 ft. For practical purposes, the atmospheric pressure P_A will be reduced one foot for each 1,000 ft above sea level. In Fig. 1, P_V 0.6 ft, H_E 10 ft, pipe friction is 2 ft, and water temperature is 60F.

$$\text{LEH} = (P_A - P_V) \pm H_E - H_F$$
$$(34 - 0.6) - 10 - 2$$
$$\text{Available LEH} = 21.4 \text{ ft}$$

Figure 2 shows an arrangement for pumping water from a tank open to atmospheric pressure and located at an elevation about 1,000 ft above sea level. In this problem, $P_A = 34 - 1 = 33$ ft; water temperature is 160F; $P_V = 11.2$ ft; $H_E = 12$ ft and pipe friction, $H_F = 10$ ft.

The available LEH $= (33 - 11.2) + 12 - 2 = 31.8$ ft

If water temperature is increased to 212F, $P_V = 33$ and the available LEH is then 10 ft. For other temperatures or liquids consult vapor charts. Viscous fluids require corrections which can be obtained from charts. Handling liquids with solids in suspension as paper slurry requires special pumps and corresponding corrections from performance charts.

A problem based on the use of a closed vessel is shown in Fig. 3. In this example, there is a closed vessel or heater with water subject to steam pressure. Water may be sprayed into the heater or cascaded in a series of water falls so that the steam comes in intimate contact with the

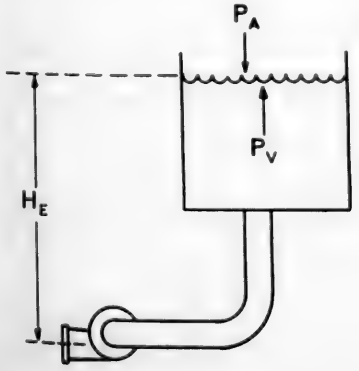
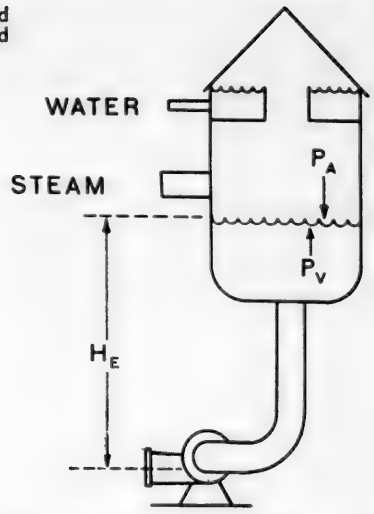


Fig. 2. Arrangement for pumping water from an open tank.

Fig. 3. Problem based on the use of a closed vessel.



water and heats it to the same temperature as that of the incoming steam. Steam at 5 psig and 227F results in a P_A of 19.7 psia. In the base of the heater, the water is at 227F and $P_V = 19.7$ psia. With $H_E = 37$ ft, and $H_F = 2$ ft, we have:

Available LEH $= (19.7 \text{ psia} - 19.7 \text{ psia}) + 37 \text{ ft} - 2 \text{ ft} = 35 \text{ ft}$.

If the steam pressure is subject to sudden pressure drops, deduct the equivalent drop in feet from the available LEH before comparing with the minimum required LEH of the pump.

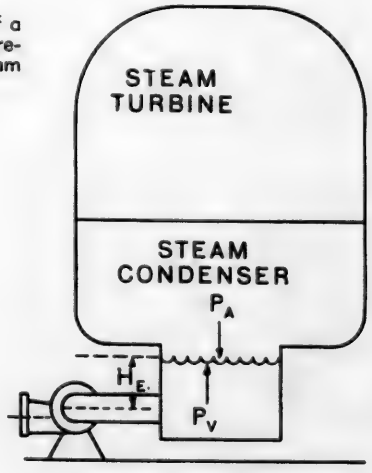
In Fig. 4 is an arrangement of a condensate pump to remove water from a steam condenser. Because of methods of construction and the expense of excavation, the hotwell is usually just barely above the basement floor. H_E is very low, often only 2 or 3 ft and seldom over 5 ft. The condensate is at the saturation point $P_V = P_A$; H_F is negligible.

$$\text{Available LEH} = (P_A - P_V) + H_E - H_F$$
$$0 + H_E - 0 = H_E$$

This H_E is often designated as "sealing head" or "submergence."

Pumps with specially enlarged inlets are usually used for this service and extreme care must be taken in their selection because of the very low LEH. Cavitation and noisy operation are common occurrences because of lack of available LEH.

Fig. 4. Arrangement of a condensate pump to remove water from a steam condenser.



LONDON LETTER

Commentary on developments in Europe by our correspondent in Great Britain

HAVING noted (July *Letter*) the tendency of Summer in England to fall on a Tuesday in August your correspondent chose Aug. 31 for a trip along Old Father Thames with the kiddies, and is now going around with a self-satisfied air and a sun tan. There was, metereologists tell us, more rain in the summer of 1903, but there has been quite enough this year to keep Edinburgh's home fires burning and justify its name of Auld Reekie, and to leave Miss Logan of Dallas (who looked down on those old smoking chimneys and to the Forth Bridge beyond some ten days earlier) with the lasting impression that (under the smoke) Britain is one vast carpet of green. Standing by Nelson's monument, she explained that Texas looks quite different. It is to be hoped that she was able to make the suggested pilgrimage to Kew Gardens before leaving this island, but a trip on the Thames can be equally recommended. Steamers go all the way, and Henley, Windsor, and the Vicarage of Bray have their attractions, but for a really peaceful day take a train to Reading in the morning and go up river to Oxford.

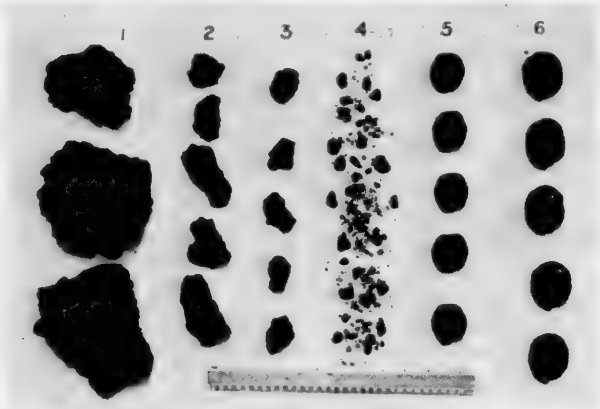
You Can't Have Your Coke and Burn It

But to return to the question of smoke. Most of it comes from burning raw coal in small appliances, such as open fires. Coal is so easy to burn, and the flames are so cheerful, that the campaign to get us to use smokeless fuel has not been very successful. In some mining areas the delivery of "cinders" one day will bring the creditors round the next; if you can't afford coal they had better get their claims in quick!

Low-temperature coke and smokeless fuels with a fair amount of "life" and volatile content are not produced in great quantity, but there is plenty of ordinary household coke. By one of the lesser known Paradoxes of Zeno, a surplus of coke springs from a shortage of gas. The steelworks carbonize coal to make a hard coke for their own purposes, and they often have a surplus of coke-oven gas, which may or may not pay for piping to the nearest gas works. But the gas concerns make coke as a by-product, coke of a quality unacceptable to the steel makers. If there was as ready a market for this as there is for gas, it would be economic to make more of both. There has therefore been a considerable research effort in Europe to find improved ways of burning coke.

There's a cafe in Oxford St., London, with a large neon sign "Here you can have your cake and *eat* it," so scoring off a popular misquotation. The original and difficult thing was to eat the cake and have it. But coke's no piece of cake. It's a most unpromising fuel, and yet it provides heating and hot water services for houses and small institutions throughout North-western Europe. Maybe it is difficult for readers in Dallas to appreciate why the shaving water is cold in the early morning of a small English hotel. Perhaps the photograph will help.

Specimen No. 1 is actually low-temperature coke, but indicates the size of the largest marketed gas works coke. No. 2 and No. 3 are these two sizes of gasworks coke, supplied for medium and small heating appliances. No. 4 is coke breeze, which was (and is still) used as a building material rather than as a fuel. Gasworks now use most of it themselves on special grates to make steam for steaming the retorts, for water-gas, and for power generation. No. 5 is a particularly expensive and high quality fuel made from anthracite and intended for solid fuel cookers of the heat-storage type, and No. 6 is made from coal dust and is a poor quality fuel, certainly not smokeless, and not considered worth rationing. These last two are put in just to emphasize the jaggedness of coke. Because (if you keep it hot) the stuff will burn. It's the handling that creates the difficulties.



Some manufactured solid fuels.

Monoxide—Dioxide—Monoxide

With gas you turn on a tap. With oil you fill a tank, throw a switch, and pumps and automatic valves do the rest for you. With coke you have a truck dump it in a heap in the yard, and you put it on the fire by hand. If you put it in an automatic stoker as for coal there'll be no threads on the screw feeder after a week or two. The only kind of automatic feed it will take to is by gravity. All this means is that if you take away the support from under it, it will fall. It is not even as easy as that, however, because if the chute is less than about ten particles wide in any direction the stuff is likely to bridge across and jam.

If you blow air at a red hot piece of coke, it will go out. If you have a bed of coke particles, close together to keep each other warm, and blow air through, a series of chem-

ical reactions takes place which are now well understood. If the coke is hot enough (and at a rate dependent on temperature) carbon monoxide is split off all surfaces. There's a small amount of CO_2 as well, up to about 5%. Much of the surface is inside the lump. Where "bare" carbon is exposed by loss of the surface oxide, more oxygen settles, with evolution of heat, thus keeping the lump hot. To maintain the temperature the heat gained by this process must be at least equal to the net loss by radiation.

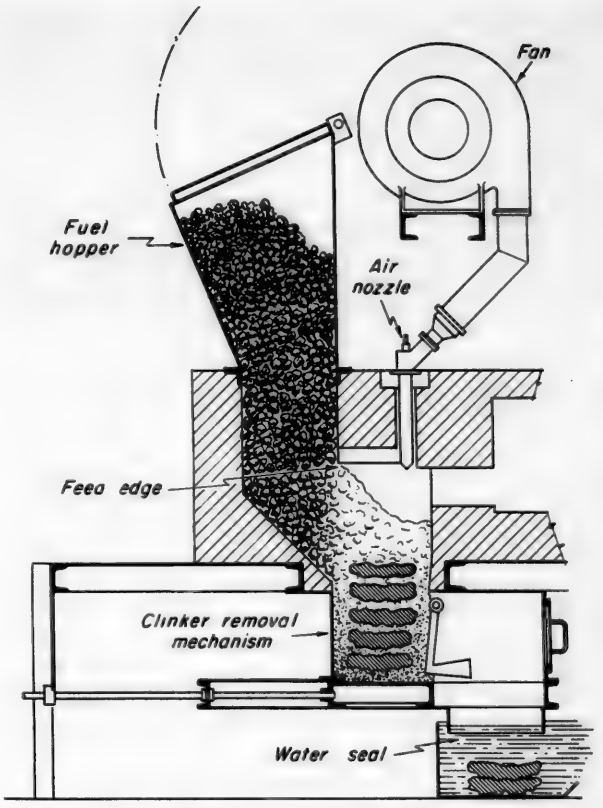
The carbon monoxide leaving the surface burns to the dioxide a short distance away, thus using up oxygen in air that never reaches the fuel surface. The result of this is that after the air has gone through the fuel bed a distance of about 1½ particle diameters, all the oxygen has become CO_2 and the theoretical temperature is getting on for 4000 deg F. Of course, this can't help warming up the next particle, which splits off CO from its surface oxide layer, and the CO_2 which then happens to reach the bare carbon gets robbed of an oxygen atom. So after a few more particle diameters much of the CO_2 has been converted to twice the amount of CO and the temperature has come down to about 2200 deg. In order to burn the CO again sufficient (and in practice excess) fresh air must be brought in and mixed well.

Problem: control the fuel bed thickness accurately without using mechanical feed, and without having any difficulties with molten ash or with abrasion of metal parts.

The Downjet Solution

Sounds impossible, but M. W. Thring got the idea at the British Coal Utilisation Research Association in the early days of the war. It really arose out of research on a gas producer to be towed behind buses and overcome the gasoline shortage. Thring is now Professor of Fuel Technology, Sheffield University, and his inaugural lecture is published in the August, 1954, issue of the *Journal of the Institute of Fuel*. F. F. Ross and G. C. H. Sharpe, also at B.C.U.R.A., made the idea work in practical applications, and within a few years there were downjet coke burners for mould-drying ovens, refractories testing, glass pot kilns, vermiculite exfoliation, and mineral wool production, as well as a small experimental steam generator of the type used for heating diesel trains.

Referring to the diagram (which is the burner end of a furnace for firing refractories) the coke is put into the hopper which has a reasonably air-tight lid. It flows out under the feed edge to form a free sloping surface, at which air is blown from the nozzle. The nozzle is adjusted so that the air quantity corresponds to the desired burning rate and the air velocity gives a penetration into the fuel bed and out again that controls the chemical reactions. Actually one gets too little penetration at the top (hence excess oxygen) and too much at the bottom (hence CO) but the gases mix in the throat to give the desired composition. The ash melts and runs down to form a clinker. If clinkers are removed at intervals by the mechanism shown, continuous operation is possible. On the other hand, the clinker in a mould-drying stove that was set to run overnight acted as an infallible automatic controller; as the stove and contents (large sand moulds) came up to temperature less heat was needed, but a flow of warm air was required to carry away the water vapor; at first the downjet burner pumped heat rapidly into the stove, but the clinker began to build up and reduce the penetration so that the combustion rate steadily fell off with no reduction in air supply. The clinker was removed daily.



Burner end of a Downjet coke burner.

Coke Burners for Space Heating

Downjet seems fine for some jobs, bringing to solid fuel a precision of control formerly obtainable only with gas and much less messy than oil, and in Ireland the idea has been found useful for burning peat. It has also been used for central heating boilers, to replace a smoky raw coal appliance. There are, however, other solutions which may be more successful for the low-temperature duty of warming water or air for space-heating. The same principle of gravity feed under a feed edge to give a fuel bed of constant shape is mostly used, but the air is arranged to pass right through and preheated secondary air is supplied to burn off the CO. Even in such types it is possible to develop a high enough temperature inside the fuel bed to melt the ash so that it runs away from the combustion zone and forms a strong, easily-removed clinker. Coke burning appliances form the subject of the Institute of Fuel's Progress Review No. 23, published in its Journal, Vol. XXV, No. 149.

The Dutch journal, *Verwarming en Ventilatie*, Vol. 7, No. 9, contains an interesting description of a coke burner which it is claimed is being widely installed for central heating purposes in Holland. The coke is allowed to fall between two vertical rows of tubes. Air passes through from front to back. The fuel bed thickness, i.e. distance between tube rows, is around 19 inches, so here again there is CO to be burnt by means of secondary air. The ash forms a clinker at the bottom and this is pushed out on the same principle as that illustrated for Downjet. It

(*Concluded on page* 168)

Louis Blendermann on

PIPING and PLUMBING

External Indirect Water Heaters for Service Hot Water

FURNISHING service hot water in a building by means of an external indirect heater and a storage tank is just one of the many efficient methods now used. This means is used successfully in buildings with a fairly large hourly demand for hot water as well as in buildings with smaller demands. It may be used with either a steam or hot water heating boiler, and the piping arrangements are shown in Figs. 1 and 2.

In these illustrations, it will be noted that both systems are similar in operation and both use boiler water as a heating medium. The chief advantage of the system shown is that since the indirect heater utilizes boiler water for heat generation, it permits a year-round supply of hot water in abundant quantities and at relatively low cost. Thus supplementary heaters for use during the summer months are not required. The only difference between the two systems is the manner in which the boiler water is supplied to the indirect heaters. The circuit from the storage tank, to the heater, and back to the tank is shown by a broken line.

This article is not intended to recommend this system over other similar systems in use, but to discuss its merits, its limitations, the purpose of its component parts and also to offer design recommendations that will provide efficient and economical operation.

The major factors that influence the selection and use of this system are the hot water demand requirements of the building, the regularity of the demand, the type of space heating boiler used, and the particular judgment of the engineer designing the system.

Size of Storage Tank

Once the hot water demand requirements of the building have been determined, it is necessary to select the proper size heater and storage tank. Table 1 lists the two types of external indirect heaters, commonly used, and their rated capacities. Although the figures in Table 1 are approximate, they are accurate enough for the purpose of example. In actual work the manufacturer should be consulted in order to obtain the rated capacity of his equipment.

TABLE 1—RATED HOT WATER CAPACITIES FOR INDIRECT HEATERS

Indirect Heater	Gallons of Water Heated from 40 to 140F in 3-Hour Periods			Recommended Size of Storage Tank, Gallons, for Heater Using Boiler Water at 180F
	Steam at 0 psi Gage Pressure	Boiler Water at 212F	Boiler Water at 180F	
Single Coil	100-300	50-150	30-120	40-100
Multi Coil	475-1,620	250-1,000	150-600	120-400

Capacities shown in the table are the number of gallons that may be generated in 3-hour periods. Values listed under the 180F temperature rating are generally used for a system that will be used the year-round, since this is the capacity of the heater during the summer months.

The storage tank is intended to bolster the output of the heater and to hold in reserve a supply of hot water necessary to meet the additional hot water demand during the peak hours of the day.

For example, if a building has a hot water demand requirement of 400 gph during one of the peak hours of the day, an indirect heater with a rated capacity of 600 gal per 3-hour period would be used in conjunction with a storage tank of a minimum of 400 gal capacity. This arrangement will satisfy the peak demand requirements and will easily handle the average demand, provided that the average hourly demand is less than 200 gph (600/3). If the peak demand exceeds 400 gph, a larger storage tank may be used.

Limitation of Supply

There are, however, certain limitations to the amount of hot water this system can furnish and yet operate efficiently and economically. With reference to the capacities listed under Table 1, it is recommended that the limit be set at a peak demand requirement of 500 gph. This would use an indirect heater with the highest rated capacity of 500 gal per 3-hour period and a storage tank with a maximum storage capacity of 500 gal. This requires that the average hourly demand be less than 200 gph.

If this limit is exceeded, it is not practical to use larger indirect heaters. Therefore, other means of hot water generation should be considered, such as a separate heating boiler, used expressly for the service hot water without the use of an indirect heater.

With the steam boiler, additional recovery is available as shown in Table 1, by the capacities listed under boiler water at 212F and steam at 0 psi gage pressure. These

higher boiler water temperatures may be used to supply 180F water for kitchen use, but this is not possible when 180F boiler water is used.

Operation of System

Assuming that the indirect heater and the storage tank have been properly sized for the hot water requirements of the building, the first item to be considered is the location of the storage tank with respect to the indirect heater. If the storage tank is so elevated that the bottom of the storage tank is higher than the top of the indirect heater, a good natural circulation of water between the heater and the storage tank will be assured. If space conditions do not permit the elevation of the storage tank, it is then necessary to install a circulating pump on the return line from the storage tank to the indirect heater, to provide positive circulation.

Indirect Heater

The next item to be considered is the piping connecting the indirect heater, storage tank and heating boiler. Although there are several different piping arrangements that may be used, the arrangements used in Figs. 1 and 2 are shown because they illustrate a method that fully utilizes the component parts of the system.

Water in the storage tank circulates through internal coils in the indirect heater. The heat contained in the boiler water passing through the indirect heater is transmitted to the water in the coils to generate hot water.

In Fig. 1, the boiler water supply to the indirect heater is taken from below the boiler water level, where the water temperature is between 170 and 180F. The tempering device installed on the return pipe to the heating boiler, controls the circulation of the boiler water through the indirect heater. If it is desired to maintain a water temperature of say 140F, in the storage tank, then the tempering device is adjusted to a setting that will maintain this temperature. When the desired temperature is reached, the device will close and retard the circulation of boiler water through the indirect heater until the temperature of the water in the storage tank is reduced to the desired value. Since boiler water aquastats control the burner operation, the system may be used for year-round performance.

In Fig. 2, the boiler water supply to the indirect heater is taken from the hot water supply line. The tempering device functions in the same manner as for the steam heating boiler. The weighted flow control valve or other approved equipment allows the burner to operate and maintain the boiler water temperature for circulation through the indirect heater and yet prevents the movement of hot water through the heating system. When hot water for the heating system is needed, the circulation pump located on the heating return line to the boiler builds up sufficient pressure to open the weighted flow control valve, thus permitting the boiler water to circulate through the heating system. This also affords year-round performance.

Hot Water Mixing Valve

A hot water mixing valve has been added on the hot water supply line as it leaves the storage tank. This valve has been included since it may be desired to maintain a certain temperature of hot water to the fixtures. The mixing valve provides an accurate means of controlling the water temperature. Both the hot and cold water supply to the mixing valve are equipped with a valve, check valve and strainer, and the strainer is installed to prevent foreign substances in the water from damaging the delicate mechanism in the mixing valve.

The mixing valve action is controlled by a temperature bulb placed in the hot water line in the location shown. The force that actuates the mixing valve is transmitted by the fluid in the temperature bulb and tubing. By enlarging or reducing the hot and cold water ports in the mixing valve, the temperature of the water to the fixtures is regulated. The temperature bulb should be placed at least 6 to 8 ft away from the mixing valve to assure accurate temperature regulation. A thermometer is installed at a remote location, as shown, where it can be easily read.

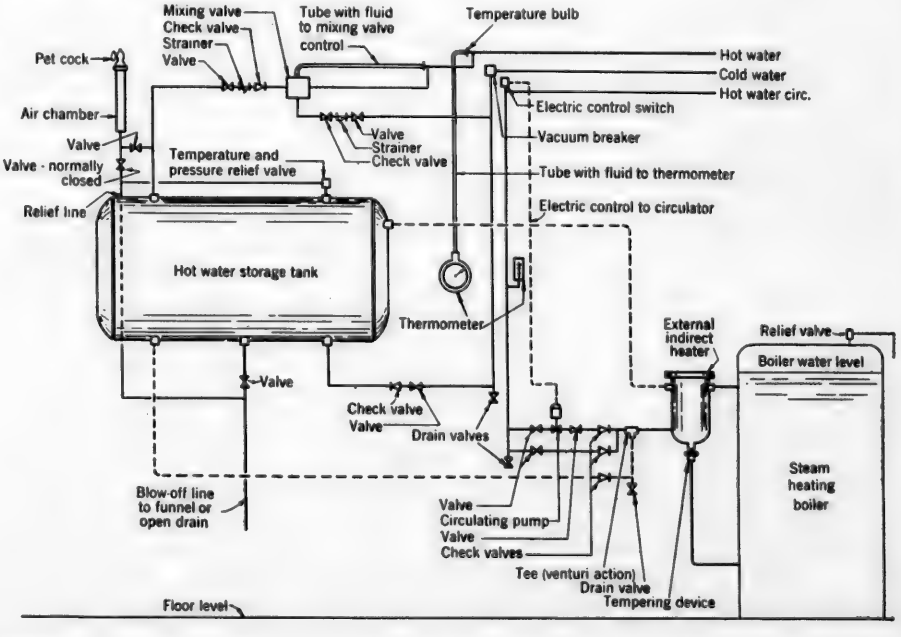


Fig. 1. Typical installation with an external indirect heater connected to a steam heating boiler.

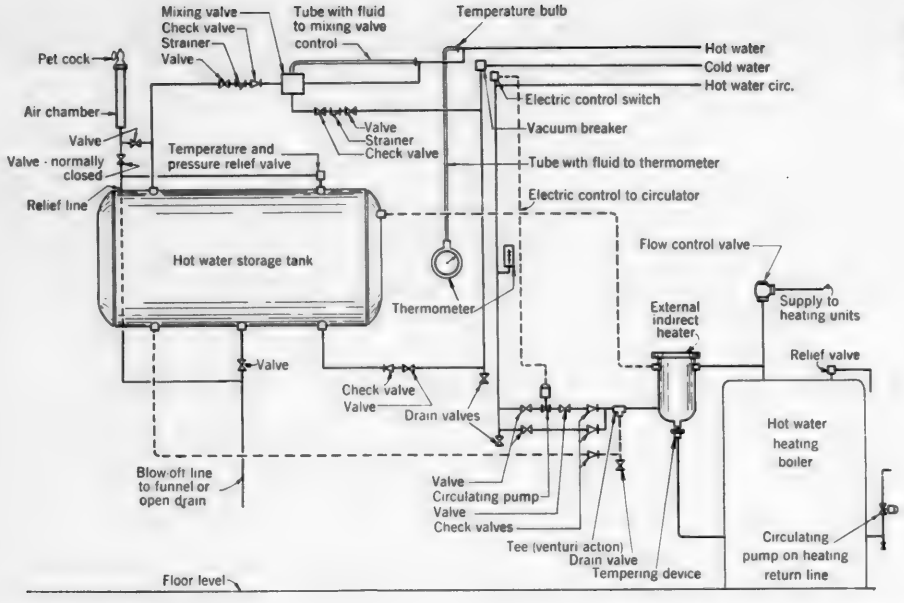


Fig. 2. System using a hot water heating boiler to serve an external indirect heater for service hot water.

Circulating Pump

To speed up the return of water in the service hot water piping system, a circulating pump is installed. The operation of the circulating pump is governed by an electric control switch set in the return line as indicated. The temperature of the hot water returning to the circulating pump will be a few degrees cooler than when it left the storage tank, depending upon the length of piping runs. Therefore, the control switch is set at a temperature range which compensates for this heat loss.

For example, if one desires to furnish 135F water to the fixtures, then the mixing valve at the storage tank is so adjusted to furnish water at this temperature. Hot water from the tank is automatically mixed with cold water to provide water at 135F. Water, in making its circuit through the piping system, will give up some heat so that by the time it returns to the circulating pump, it may be 130F. It is possible to set the electric control switch for the proper range of circulating pump operation. For example, using a 5F differential for the pumping cycle, the circulating pump will operate when the water in the return line drops to 125F and will shut off when the temperature again reaches 130F. If desired, a larger temperature difference may be used for the upper and lower limits.

The thermometer on the return line, as illustrated, aids in the suitable setting of the electric control switch.

Return water from the storage tank is connected to the hot water circulating line by means of the special tee connection shown. The purpose of the tee connection is to speed up the movement of the water in the storage tank by venturi action while the circulating pump is in operation. When the circulating pump is not operating, the water in the storage tank will still move by natural circulation which is benefited by the elevation of the storage tank.

Cold Water Supply

The cold water is connected to the storage tank in the position shown because this is the farthest point from the hot water outlet and the return outlet to the indirect heater. In this location, the cold water will spread out more evenly along the bottom of the tank without mixing with the hot water in the tank. A vacuum breaker is placed on the cold water line to prevent siphonic action, in the event of a drop in water pressure.

If proper consideration is given to the hot water requirements of a proposed building and to the capacity of the equipment used, it will be possible to provide a service hot water system that will furnish abundant quantities of hot water in a most efficient and economical manner.

New Steam Business Obtained in 1953

According to figures presented by S. S. Sanford in a committee report before the 1954 convention of the National District Heating Association, a total of 529 new steam customers were added in 39 cities. Of the new customers, 15 per cent had used district heating at a previous time, 68 per cent are in old buildings using district heating for the first time, and 17 per cent are in new buildings.

There were 112 customers in 16 cities who discontinued use of the service for some other method of heating. In Boston, 66 customers with an annual revenue of about $119,000 were lost because of oil competition, and in Springfield, Mass., one customer who represented a business of about $16,000 a year was lost for the same reason.

In five cities, distribution facilities are not sufficient to add new customers. In 37 cities, distribution facilities are adequate. Additions to distribution systems were made in 15 cities in 1953 and in 12 cities, additions are to be made in 1954.

NEWS OF EQUIPMENT AND MATERIALS

Use the handy prepaid postcard, page 136, for securing additional information on items described in this department.

Cooling Tower for Tight Spots

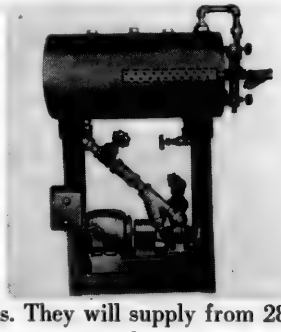
A Take-Apart cooling tower which the maker claims to be an innovation in installation of air conditioning equipment, is introduced by Halstead & Mitchell, Pittsburgh, Pa.

Designed to be installed in crowded basements reached by narrow stairs, or on roof tops, where the expense of a rigger for hoisting can be eliminated, the cooling towers permit the use of water-cooled air conditioning in quarters never before considered mechanically or economically feasible. The cooling towers are shipped assembled, and then are separated into several sections by easy-to-get-at bolts. Parts may then be carried on narrow stairs, or on a small elevator, or hoisted to the roof without the expense of a rigger. Manufactured in a size range from 5 through 30 tons, the towers feature a 20-year guarantee on the wetted deck surface against rotting or damage due to fungus attack. Drive shafts and fans are made of stainless steel, and the housing is protected with vinyl zinc, vinsynite and chlorinated rubber.

More information? Circle Item 1 on postcard, page 136

Boiler Features Pre-Heater

A boiler feed system incorporating a pre-heater that operates on steam from the boiler has been added to the line of boiler feed systems manufactured by Cyclotherm Div., United States Radiator Corp., Oswego, N. Y. The units are said to automatically maintain boiler feed water between 190 and 200 deg F. Tank sizes on the units range from 30 to 540 gallons. They will supply from 280 to 2800 gallons of preheated water every hour.



A perforated tube inserted horizontally in the feed water tank is connected to the steam supply. The unit is thermostatically controlled so that steam is allowed to enter the unit only when the temperature falls below a predetermined point. A thermostatic bulb filled with a pressure-sensitive fluid controls a flexible bellows that mechanically opens and closes the valve, varying the opening or completely closing it.

More information? Circle Item 2 on postcard, page 136

Bellows Have Companion Flanges

Chemically inert, corrosion and heat resistant bellows made from DuPont Teflon are now available from Crane Packing Co., Chicago, Ill. With companion flanges conforming to American Standard bolt hole circles, and numbers for pressures up to 125 psi, the bellows can be supplied to fit any pipe size from ½ through 12 inches.

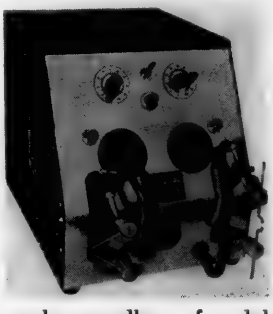
The bellows feature a new convolution form which is said to give greater strength, longer life and increased flexibility. Since they retain formation at full free length, they are subjected to minimum residual and working strain. They expand and contract in either direction with equal freedom of motion. Operating temperature range is from —94 to +500 deg F. Bellows flanges are of French-type gasket construction to provide more efficient sealing at lower flange pressure. Gasket insert material is asbestos or synthetic rubber.

Typical applications for the bellows include vibration dampeners, expansion joints and connectors. They are available in a wide range of designs suitable for metering pumps, pressure accumulators, and hydraulic systems.

More information? Circle Item 3 on postcard, page 136

Small Parts Resistance Welder

A low cost, 1 kva, small parts resistance welder with dual heads that can be quickly and independently adjusted for pressure, time and heat in progressive assembly work has been developed by Royson Engineering, Hatboro, Pa. The electrodes and holders are adjustable in all directions permitting a wide variety of setups.



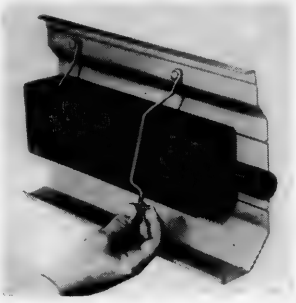
The unit, sold as a complete package containing welding heads, timers, controls and transformer in a specially constructed cabinet, handles strip and wires up to 1/32-inch. Air cooled, ⅛ or 3/32-inch electrodes are used which maintain constant pressure on the work regardless of pedal movement and force. The electronic timers use cold cathode thyratrons for long, trouble-free service. The tube is active only during the actual welding cycle. A knob at the front of the cabinet permits fine adjustment of heat. Welding current on the welder passes through electrodes and holders only and not through castings or any other parts.

Two foot pedals and chains are provided with the unit and special holders and fixtures can be provided. The unit operates from any conventional 220 volt, 60 cycle, single phase outlet.

More information? Circle Item 4 on postcard, page 136

Baseboard Radiation Hanger

An element support hanger for use with baseboard radiation has been developed by C. A. Dunham Co., Chicago, Ill. It is claimed that this element simplifies the installation of the company's baseboard radiation.

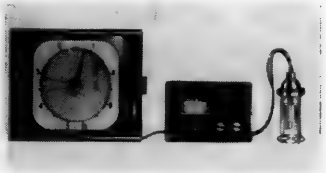


A unique double-headed nail assembly is used to nail back section of the baseboard to ground strip on the studding. The hooked end of the wire element hanger is slipped over the double-headed nails and the speed nut is positioned on threaded end of hanger to support element. Front enclosure and accessories then snap on, and the job is complete.

More information? Circle Item 5 on postcard, page 136

Systems for pH Instrumentation

Complete systems for pH recording and control, which incorporate the Beckman Model W amplifier, are announced by The Bristol Co., Waterbury, Conn.

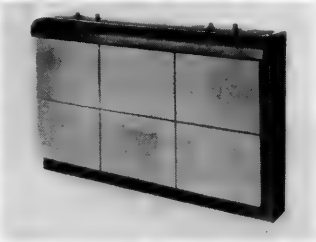


These pH instrument systems include the company's Electronic Dynamaster Potentiometer recorder or controller, a Beckman Model W amplifier, electrode assemblies in either flow or immersion types, and a variety of final control elements for the addition of gaseous, liquid, solid, or slurried reagents.

More information? Circle Item 6 on postcard, page 136

One-Pipe System Heats, Cools

An all-liquid year-round air conditioning package for homes that provides winter heating and summer cooling in a one-pipe system is introduced by Brown Products Co., Forest Hills, N. Y. In the room is the air conditioner which is a heating-cooling room unit. It is fully factory assembled and requires only piping and electrical connections. The air is cleaned by filters from the conditioner and discharged into the room by two-speed blowers, after passing over coils through which hot water circulates during the winter and chilled water during the summer. The room units are installed on a simple one-pipe system almost identical with the usual monoflow forced hot-water system.



A conventional heating boiler is used during the winter. A water chiller is located in the boiler room for summer cooling. The chiller is air-cooled and needs no cooling tower. It comes in 2 hp and 3 hp. capacities, with two 1 hp compressors in the 2 hp size and three 1 hp compressors in the larger. This permits automatic step operation at partial loads. The air conditioner has a low pressure drop for water flow, thus it can be installed on a monoflow system using a circulator similar to that in residential wet heating systems. During the cooling cycle a circulator operates continuously. The blowers in the room units operate at high speed until the controlling room thermostat is satisfied. Then they automatically switch to low speed. When the blower is operating at low speed, the air passes more slowly over the coils, thus increasing dehumidification of the air.

As the cooling cycle starts, only one of the 1 hp compressors in the chiller operates. The other compressors are not used unless return water temperature, as measured by a thermostat bulb in the return line, rises above factory preset value. Then the other compressors cut in to provide additional cooling. On very hot and humid days when the system may become overloaded a limit switch in the return line cuts to low speed the blowers in all the room units operating at that time, instead of shutting off the system completely. This will reduce the load and also allow for greater dehumidification and a certain amount of sensible cooling. For the heating cycle each unit is equipped with a reactor coil which permits six different speed settings for low speed, thus controlling heat output from the unit at a preset water temperature in the system. The operation of the system is similar to a conventional forced hot water system, the circulator and blowers operating intermittently when the thermostat calls for heat. On the heating cycle blowers operate at low speed. Although the system is adapted to a typical two-bedroom home, it is also suited to a variety of commerical buildings, including motels, hotels, and offices. It is equally well adapted to modernization work as to new construction. The system can be installed with heating only, omitting the chiller until the owner is ready to add cooling.

More information? Circle Item 7 on postcard, page 136

Heating System Air Eliminator

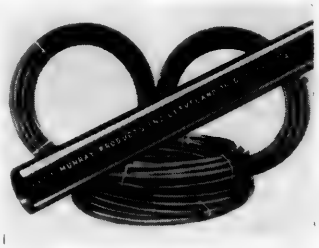
An air eliminator for hot water heating systems is offered by H. A. Thrush & Co., Peru, Ind. Recommended for floor, ceiling, and baseboard radiant systems, the device is installed in the return main, where it collects and eliminates air from the system.

The air eliminator breaks the water flow, causing air to flow with circulation and be trapped in the eliminator. Each eliminator comes factory equipped with the company's No. 5 air vent which automatically releases the air and maintains the proper water line in the eliminator. The eliminators are individually cartoned and furnished with complete installation instructions.

More information? Circle Item 8 on postcard, page 136

Plastic Pipe Resists Sunlight

The production of a new polyethylene-base flexible plastic pipe designed to eliminate the deteriorating effect of sunlight is announced by Munray Products, Inc., Cleveland, Ohio. The manufacturer states that the flexible, lightweight pipe is produced from virgin materials, and contains no anti-oxidants or pigments that would tend to make it toxic.



The pipe can be used in buried as well as above-grade installations in all types of domestic, farm, industrial, chemical and food processing applications within its temperature and pressure properties. The pipe can also be used to convey potable liquids, slurries, chemicals, and electrical conduit.

Additional features include high resistance to electrolytic corrosion, rust and rot, low friction loss, no interior build-up, and immunity to the effects of corrosive waters, soils and a wide range of chemicals including most solvents. The pipe is flexible enough to permit bending around most obstacles without kinking and is light in weight.

More information? Circle Item 9 on postcard, page 136

Bi-Metal Air Valves

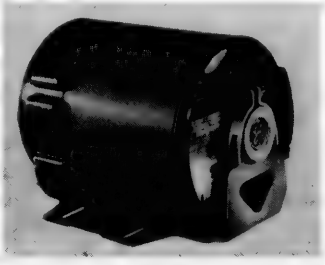
The availability of its Nyavco No. 80 series of bi-metal air valves is announced by New York Air Valve Corp., Brooklyn, N. Y. The valves are available in ⅛, ¼ and ½-inch sizes, and ¾ x ½-inch lower male connection.

The valves have a rugged outer shell mounted in a heavy brass base which houses an open float activated by several bi-metallic elements. The valves are not affected by water hammer since the open float permits equalization of internal and external pressure and allows cushioning of the blow on the trapped air. The sensitive bi-metallic elements are instantly affected by every degree change in temperature, thereby shortening the closing and opening cycle considerably and are therefore able to maintain constant maximum temperature in radiators at all times.

More information? Circle Item 10 on postcard, page 136

Fractional Horsepower Motor

A totally-enclosed, split-phase fractional horsepower motor, smaller and a third lighter than previous designs, is announced by General Purpose Component Motor Dept., General Electric Co., Schenectady, N. Y.



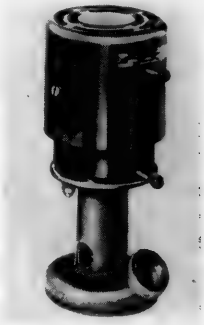
Designed for driving light machine tools and materials handling systems, the fan-cooled motor incorporates large-size ball bearings to absorb heavy thrust loads.

The motor has a large, built-in terminal board and easily accessible base slots for simplified installation, with mounting dimensions the same as for standard open motors of the same rating. In NEMA 48- and 56-frames, the motor is available in ratings of 1/6, 1140 rpm, to 1/3 hp, 3450 rpm, 60 cycles. Also available are 50 cycle models.

More information? Circle Item 11 on postcard, page 136

Pump Features Small Size

An immersion type pump series, called the H-3000, which features small, compact size is placed on the market by Graymills Corp., Chicago, Ill.



The pump, which has ample reserve horsepower to assure long motor life, delivers a steady, abundant flow of liquids of light viscosity. The pump will operate with an unusually low liquid level without splashing. Made of bronze castings and stainless steel, the pump has a shaded pole motor which is fully enclosed and fan cooled. No mechanical starting switches are required.

Uses for these pumps include ice making machines, milk coolers, displays, coolant systems for small grinders and masonry saws, and wide application in the refrigeration and air conditioning fields.

More information? Circle Item 12 on postcard, page 136

Heater Has Removable Fan

A downblow unit heater, with a motor and fan that can be removed from the bottom of the unit, and a die-formed full venturi, is being marketed by Heating and Cooling Div., Union Asbestos & Rubber Co., Chicago, Ill.

The motor mountings are completely separated from the coil and heated air stream and are attached to special rubber mountings in the bottom of the motor well. The design of the well enables the serviceman to loosen four bolts in order to drop the well, motor and fan from the unit. However, the design is such that there is no possibility of the assembly working itself loose and accidentally dropping out. Available in both one and two-row coils, the heater is available with outputs ranging from 40,000 to 580,000 Btu per hr.

The company has grouped these unit heaters into four classifications, by quietness level, ranging from one to four. The quietness level for Class I units makes them suitable for court rooms, class rooms, hospitals, private offices and theaters. Class I units can be installed in hotel dining rooms, show rooms, small stores and similar places. Class III and IV units are designed for use where relatively higher noise levels can be tolerated.

More information? Circle Item 13 on postcard, page 136

Expanded Highboy Line

Included in a new line of automatic heating equipment introduced by The Heil Co., Milwaukee, Wis., are the UF-2 oil-fired winter air conditioner and its companion model for gas. Both are of highboy design, and supplement Models UF-1 and UFG-1, respectively.

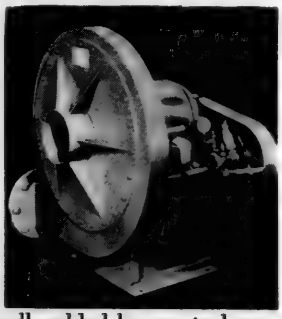
Oil fired models UF-1 and UF-2 are rated, respectively, at 89,600 Btu per hr and 112,000 Btu per hr at the bonnet, and models UFG-1 and UFG-2 for gas carry AGA input ratings of 100,000 Btu per hour and 125,000 Btu per hr, respectively. New features offered by each of the four highboys center largely about the design of their heat exchangers, including added heating surface, protection against expansion noises, greater serviceability and an improved construction which eliminates corrosion within flue tubes. The larger units feature heat exchangers of octagonal design.

Convertible from one fuel to the other, all models are compact in design and are finished in two-color baked enamel.

More information? Circle Item 14 on postcard, page 136

Turbo-Pressure Blowers

Turbo-pressure blowers which maintain a constant pressure while supplying varying volumes of air are a new product of Chicago Blower Corp., Franklin Park, Ill. The fans are available with single or double inlets, and direct or belt-driven.



The wheels are of lightweight, high strength construction. Exhauster type S wheel is used in the single inlet fans, and blower type D wheel is used in the double inlet fans. The housings are of all-welded heavy steel construction. The front and back plates are rigidly braced with gusset plates. The bases are of heavy welded construction with triangular back support. Any type of special base to meet individual operating requirements can be furnished. The inlets are designed to reduce shock loss. The outlets are large, and reduce friction when piped to full size. The blowers are designed to deliver their rated capacity only when operating at 3450 rpm, for air pressures from 4 to 24 oz.

More information? Circle Item 15 on postcard, page 136

High Velocity Converter

A high velocity converter, which is an air flow adjusting device designed to regulate the flow of air out of high velocity supply ducts is introduced by the Pyle-National Co., Chicago, Ill.

The device regulates the flow of air out of high velocity supply ducts by reducing the static pressure in the vicinity of the outlet, through the principle of static pressure regain. This converter makes possible the air conditioning of a room, or area, off of a main high velocity supply duct, without need for bulky acoustical treatment.

The converter performs in a manner somewhat analagous to that of a toy electric train transformer. Whereas an electric train transformer will reduce 110 volts to 6 volts, in order to avoid shock and fire, this new converter will "bleed off" into a room or area, from the main, high velocity air ducts, just enough air to effect the desired temperature, without disturbing the flow and pressure of high velocity air through the central ducts. Just as a toy train transformer eliminates the possibility of shock and fire, this converter eliminates noise and blasts of cold air, as the air is channeled off the central ducts, into a room.

More information? Circle Item 16 on postcard, page 136

Purifier Aids Allergy Victims

Relief for asthma and hay fever sufferers in the form of an air purifier is announced by Norge Div., Borg-Warner Corp., Chicago, Ill.

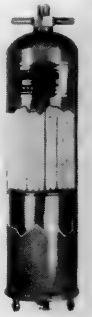
Called the Norge-Aire, the air purifier removes 99.4 per cent of the pollen, mold spores, house dust, and other common air-borne allergens from room air, according to the company.

The appliance includes a window-adapter kit and it can be used as a window unit or as a table model.

More information? Circle Item 17 on postcard, page 136

Unit Handles Compressed Air

Two models of its Condensifilter for dehydrating and filtering compressed air are announced by Hankison Corp., Pittsburgh, Pa.



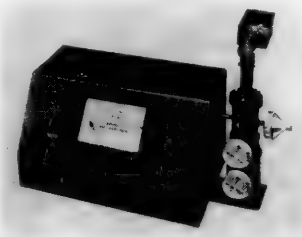
The units, M-30 and M-100, are rated at 30 and 100 scfm respectively, at line pressure of 100 psig. Both models feature a condenser to reduce compressed air dew points, plus a disposable filter cartridge for removing solid particles. The prefabricated steel case has a spun elliptical head that permits operating pressures up to 200 psig. All sealing is with O rings, eliminating the need for tools to dismantle the units for service.

In operation, compressed air enters the unit through the steel center shaft and passes into the spiral copper condensing section. The condenser reduces the temperature of the air to within 2 or 3 degrees of the cooling water temperature. The air then passes upward and through the cotton felt filter cartridge, reenters the center shaft, and returns to the system. Condensed vapors drop into the condensate collection chamber, and can be manually discharged or trapped to drain.

More information? Circle Item 18 on postcard, page 136

Aerosol and Smoke Photometer

A forward-scattering aerosol and smoke photometer designed for the study, measurement, and control of air pollution and particulate matter suspended in aerosols is announced by Phoenix Precision Instrument Co., Philadelphia, Pa. It has numerous other applications such as a control and research tool for rapid evaluation in filter designs, testing efficiency of fans, air-wash systems, and air conditioners or in medical research for studies and measurement of respiratory accumulation of dust and smoke particles.



This instrument features extreme sensitivity by measuring forward-scattering at small angles which may be 100 to 10,000 times greater than the scattering in all other directions. Many standard and special accessories are available such as recorders, logarithmic and linear amplifiers which further extend the instrument's usefulness.

More information? Circle Item 19 on postcard, page 136

Winter Air Conditioner

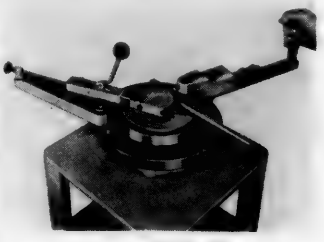
The availability of its 541 Series oil or gas fired Hi-Boy winter air conditioner is announced by Thatcher Furnace Co., Garwood, N. J.

A new low-cost unit designed to operate efficiently with either oil or gas, the manufacturer states that the unit will meet the demands of builders and dealers in today's competitive market. With an output at the bonnet of 79,200 Btu per hr, the unit is factory assembled for easy installation, carries the company's 10-year guarantee. The entire unit is AGA approved.

More information? Circle Item 20 on postcard, page 136

Clamping Device for Benders

A material clamping device designed for both Di-Acro Benders No. 1 and 1A is offered by O'Neil-Irwin Mfg. Co., Lake City, Minn.



Designated Di-Acro Quik-Lok Clamp, this new accessory is said to be valuable when forming tubing, angle, channel and extrusions on the No. 1 and 1A models of the Di-Acro Bender because it locks the material securely in position and can be instantly released to remove the formed part.

The company pointed out that the clamp can be easily adjusted for any radius to 2 inches on the No. 1 model and 6 inches on the No. 1A model, and will handle stainless steel tubing up to ½-inch diameter, round steel bar up to ⅝-inch, as well as many other types of material within the capacity of the No. 1 and 1A benders.

More information? Circle Item 21 on postcard, page 136

Automatic Valve for Testing

In one quick operation you can now connect and seal gas, air or liquid pressure lines to standard openings for testing vessels, appliances, systems or assemblies with a product introduced by Mechanical Products Corp., Chicago, Ill.

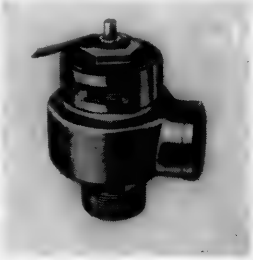
The device is called Connecto-Valve by the manufacturer, who states that only one or two seconds are required to seal an opening and begin the flow of gas, air or liquid. Inserting the valve into an opening and depressing the cam lever simultaneously expands the connecting seal and opens the valve, effecting a leak-proof seal and releasing a full flow of gas, air or liquid into the vessel or assembly under test. Withdrawal of the unit automatically closes the valve. Corrosion resistant materials are featured in the construction of valve body and component parts are designed for long service. Neoprene seals are readily replaced.

Inlet connections are tapped into valve body for ⅜ pipe pressure lines. The valve is available from stock for sealing ½, ¾ and 1-inch pipe openings. Extra adapters and seals for stock sizes are interchangeable on valve bodies.

More information? Circle Item 22 on postcard, page 136

Safety and Relief Valves

Two ASME standard, N.B. certified safety and relief valves for steam heating and hot water boilers are added to the line of Kunkle Valve Co., Fort Wayne, Ind.



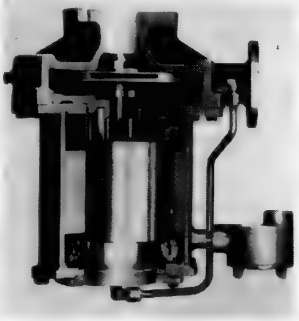
The safety valve, known as Fig. 215, is set at 10 or 15 lb for large and medium size commercial and industrial steam heating boilers. It is a high capacity, nozzle type valve of shell molded cast iron, cadmium plated inside and out. The valve incorporates a reversible steel lift lever for pull-up or pull-down installations.

The relief valve, known as Fig. 237, is set to 30 to 125 lb pressure for hot water heating boilers or hot water supply boilers and lines. The valve is all cast bronze and brass. Under normal firing conditions this valve relieves the thermal expansion, then closes off. In an emergency, the excess heat is discharged either as boiling water or steam.

More information? Circle Item 23 on postcard, page 136

Centrifugal Pump Is Leakproof

A totally enclosed canned rotor pump which has the motor and pump combined in one compact package is being marketed by Chempump Corp., Philadelphia, Pa. Called the Chempump, the manufacturer states that the pump eliminates mechanical seals, stuffing boxes, and packing glands, thereby eliminating many of the problems encountered with the maintenance of centrifugal pumps.



The pumps are available in cast iron, stainless steel, and Monel construction, with a wide variety of other materials available on request. Sizes range from ⅛ to 3 hp, giving capacities up to 180 gpm at head pressures up to 90 feet. 1/3, ¾, 1, 2, and 3 hp models have Underwriters Laboratories approval for explosion proof operation in Class 1, Group D service.

Standard models can handle fluids at temperatures to 450 deg F and pressures to 150 psi. Simple modifications permit pumping at temperatures to 600 deg F and at pressures to 5000 psi, while special models are available to handle even greater extremes of temperature and pressure.

More information? Circle Item 24 on postcard, page 136

Chiller Has High Capacity

A large capacity, low temperature chilling machine is announced by Cincinnati Sub-Zero Products, Cincinnati, Ohio.

The chilling chamber size of the unit is 36 x 42 x 36 inches deep, providing 27 cu ft of usable space. Exclusive of an outside mounted agitator motor, the overall dimensions of the machine are 96 inches long x 60 inches wide x 48 inches high. Adjustable temperature control is provided from —70 deg to —150 deg F. Thermal capacity is 8000 Btu per hr at 120 deg below zero. This is sufficient to chill 200 lb of steel per hr from +80 to —120 deg. The unit is specifically designed for large heat treating operations. For use with convection fluid, a ⅓ hp agitator is mounted in the left rear corner of the chilling chamber. A draft tube and fillet on the agitator provide for controlled flow of convection fluid and uniform rapid cooling. For draining of convection fluid, a ¾-inch drain has been placed in the bottom of the chilling chamber leading out to a valve in the rear. When the unit is used without convection fluid, an air circulator mounted in the lid, with inlet and outlet ducts entering directly into the chilling chamber, speeds chilling and prevents stratification of air.

Instrumentation consists of a recording controlling thermometer graduated from —150 deg to +50 deg F. The unit features all-steel construction. It is powered by two 2 hp motors. The chilling chamber is of heavy gage steel to withstand fatigue of loading large heavy parts.

More information? Circle Item 25 on postcard, page 136

Trencher Has Hydraulic Drive

A gear-driven trencher with the gears running in oil has been placed on the market by Auburn Machine Works, Inc., Auburn, Neb. The model has the trencher unit well forward of a Jeep body, and over the frame. The manufacturer states that by having the center of gravity ahead places more weight on the front wheels making for better traction, straighter trenches, improved steering and roadability between jobs, and less stress on the frame.

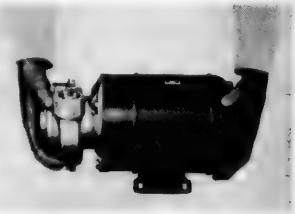
The box section frame is electrically welded, completely enclosed and serves as a dust proof housing for the major components of the unit which is called the Jeep-A-Trench Gear-Draulic. In addition, lubrication of the five major bearings has been centralized with fittings beside the control levers. The engine power is transmitted through a gear drive connected to the Jeep center power takeoff, supplying power to the digging ladder. The hydraulic drive provides the unit with a forward speed which is infinitely variable from zero to fully engaged.

The boom is raised and lowered hydraulically to any position in the 190 degree arc of travel. Weight of the trencher is approximately 1750 pounds. Four levers control the unit in operation. The Jeep clutch, gear engagement, raising and lowering of the boom, and the trenching speed are controlled from one spot by one man. The unit will handle trench width from 6 to 14 inches and any depth to 6 feet. Trenching speed depends upon soil conditions, but the manufacturer states that the unit is capable of 800 ft per hour.

More information? Circle Item 26 on postcard, page 136

Pump Features Mechanical Seal

The addition of type LL Bilton pumps featuring the company's mechanical seal as standard equipment to its close-coupled pump line is announced by Byron Jackson Co., Los Angeles, Calif.



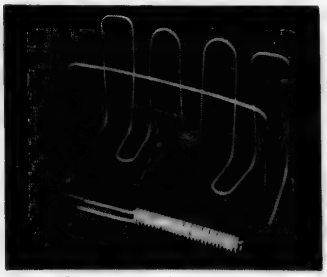
The pumps are single stage, single suction with an enclosed impeller and require no rigid foundation or base. They deliver up to 80 gal per min at 75 ft head, and handle up to 150 ft heads at lower capacities. Temperatures to 150 deg F and suction pressures to 75 psi can be handled. The pumps can be mounted vertically, horizontally, or at any angle. Pump cases can be rotated for horizontal or verticle discharge.

The pumps are adaptable to small-capacity services including air conditioning, refrigeration, swimming pools, cooling towers, small irrigation, coolant oil pumping, and for general pumping needs in both industrial and municipal building services.

More information? Circle Item 27 on postcard, page 136

25-Foot Flexible Heaters

Its Corox heating units in continuous lengths up to 25 feet with an outside diameter as small as 0.230 inch are available from Industrial Heating Dept., Westinghouse Electric Corp., Meadville, Pa. These heaters can be formed into shapes and sizes to effectively heat almost any surface or enclosure.



Use of single, low-watt density heaters in lengths as long as 25 feet eliminates the sets of two or more heaters which require additional terminals, wiring and assembly labor. The single piece heater can be formed into many intricate shapes, for example, a box to cover as many as five sides of an evaporator or freezer shelf, or the heater can just as easily be formed into a tight coil. Neoprene covered lead wires are attached to the heater terminals and sealed under pressure to provide a moisture seal and mechanical strength. The heaters are made in copper, steel, aluminum, Incaloy, Inconel, and other alloy tubings.

More information? Circle Item 28 on postcard, page 136

Adjustable Non-Clog Insert Box

A low cost insert box that combines a clogproof feature with a patented adjustable arrangement is a development of Super Grip Anchor Bolt Co., Philadelphia, Pa.

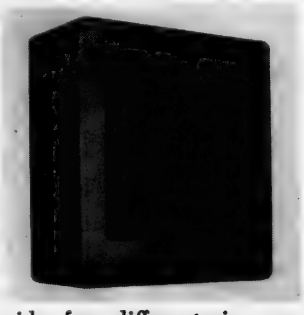
The knock-out feature eliminates stuffing the box with paper or taping the face opening inserts to prevent concrete seepage. Insert nails flush to forms at four corners to resist action of vibrators. One tap with hammer removes knock-out face slug and readies box for use. Adjustment is provided by the lateral face opening and combined with an expanded sidewall section and offcenter nuts allows movement in all directions.

Two styles are available, one for regular slab construction and a shallow type for thin slab construction.

More information? Circle Item 29 on postcard, page 136

Steam Unit Heaters Introduced

A complete line of steam unit heaters to meet a wide range of heating needs in factories, stores and offices is introduced by Ilg Electric Ventilating Co., Chicago, Ill.

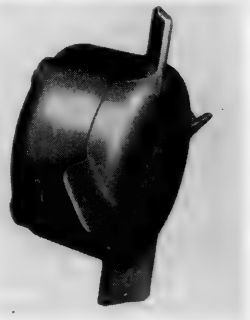


The heaters are available in 16 horizontal and 12 vertical types. Also available is a special model without fins designed for use in textile plants. Side entrance on the horizontal models provides four different pipe connection arrangements, each easily made and permitting maximum headroom. An improved louver arrangement assures efficient heat flow and all models are equipped with totally enclosed motors to drive the propeller fans.

More information? Circle Item 30 on postcard, page 136

Direct Drive Fan Motors

A series of direct drive fan motors specifically designed for use in home, commercial and light industrial ventilation equipment, has been placed in production by Electric Motors and Specialties, Inc., Garrett, Ind. Major design features of the three units in the series are listed by the manufacturer as single point mounting with floating action, a cast aluminum, rotating end bell which features integral cast flanges tapped for quick screw mounting of individual aluminum blades, also supplied by the manufacturer.



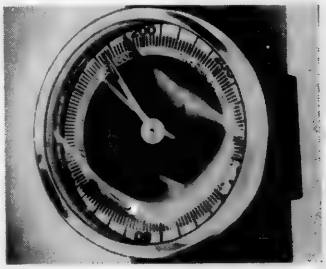
A major feature the manufacturer states, are reduction in weight by the elimination of extra bearing blocks, reduction pulleys, belts, hubbed fans, fan shafts and mounting hardware. An additional advantage is the greatly reduced overall depth realized on equipment using the company's motors, which need be no greater than 4½ inches.

Power ratings for the three motors are 1/12 hp for the SP-60A, 1/8 for the S-13E (shown), and 1/6 for the S-16. S-13E and SP-60A have four blade flanges each; S-16 has six flanges.

More information? Circle Item 31 on postpaid, page 136

Surface Thermometer for Pipes

A pipe surface thermometer to be used to obtain the temperature of pipes and tubes from ½ to 2 inches in size is placed on the market by Pacific Transducer Corp., Los Angeles, Calif.

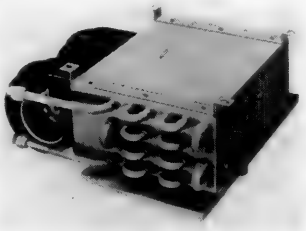


The thermometer is fastened to the pipe by means of a spring clip without the use of any tools. The spring is pushed over the pipe by hand and snaps into place. The temperature sensitive element is a calibrated bimetal and is closely coupled thermo-dynamically to the pipe. The accuracy is plus or minus 2 deg over the entire range of the thermometer, which reaches stability within 5 minutes. It is not necessary to open any pipe joints to install this thermometer. The bimetal element is protected by a copper cup which is made to fit the pipe closely. The pipe surface thermometer comes in two ranges, one from —50 deg F to 250 deg F, and the other from 70 deg F to 370 deg F. The thermometer dial is 2 inches in diameter.

More information? Circle Item 32 on postcard, page 136

Heavy-Duty Double Inlet Blower

An evaporator of compact design for fractional horsepower compressor jobs, called the Twin Chiller, is introduced by Rempe Co., Chicago, Ill.



The unit is designed for use on all cooler jobs for holding temperatures from 34 to 50 deg with lowest suction gas 24 deg, such as beverage coolers, delicatessen reach-in coolers, pharmaceutical refrigerators, back-bar coolers, hospital refrigeration, laboratory reach-in coolers, candy display cases, hotel lobby show cases, and flower display cases. The unit is available 4 or 6 tubes wide and built for use with Freon 12 or Freon 22. The coils are available hot dip galvanized for use with ammonia. Construction features include 5/8-inch diameter copper tubing, collared aluminum fins (4 per inch), removable drain pan with 3/4-inch condensate drain, ceiling mounting brackets, double blower of 275 cfm capacity, built-in plenum, 1/2 hp, 110 volt, 60 cycle a.c. motor, 1/2-inch flare inlet, and 5/8-inch flare outlet. The unit, which weighs 28 lb, is tested at 350 lb air pressure, dehydrated and sealed.

More information? Circle Item 33 on postcard, page 136

Diffusers Blend With Baseboard

Two types of baseboard blenders are introduced by The Coleman Co., Wichita, Kan., for use in the company's Blend-Air system for home heating and cooling. The baseboard blenders are designed to blanket outer wall surfaces with warm or cool air. thus counteracting infiltration. Useful in either new construction or remodeling, both of the baseboard blenders are installed without cutting into walls or floor.

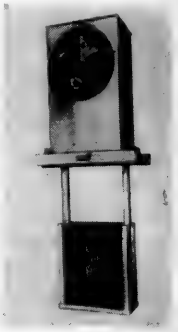
The baseboard perimeter blender (right) has been designed to be located in an outside wall, usually beneath a window. It delivers a fan-shaped curtain of air, warm or cool, close to the wall, thus blocking the outside heat or cold at its source. The unit is 28 inches long, 6 inches high and projects only 2 5/16 inches from the wall. Louvered sections in the exposed face of the blender permit room air to enter the mixing chamber and blend with hot or cold air from the furnace or cooling unit. The blender air is then delivered at ideal velocity and temperature through louvers in the top of the blender.

The baseboard innerwall register (left) performs a similar function in blocking outside heat or cold, but is installed on an inside wall, with louvers set to direct conditioned air toward the perimeter of the room. The exposed part of the blender is 14 7/8 inches wide, 13 7/8 inches high and 2 3/16 inches deep. Because the blender can be recessed in the stud space with the facing covering the outlet opening of old gravity heating systems, the innerwall air blending unit is especially applicable in modernization jobs.

More information? Circle Item 34 on postcard, page 136

Cooler Unit Is Ductless

An air conditioner which requires no water or ductwork is offered by Simplaire, New York, N. Y. Completely self contained it looks and works like a space heater, except that it cleans and cools the air instead of heating it.



Each unit has a 2-ton refrigerating capacity and can be centered in hot spots within the plant building. Or, multiple units can be spaced throughout a large, open working-area for overall cooling. The manufacturer states that the basic unit is low in cost and by adding units gradually, where needed, a plant can be air conditioned at low cost over an extended period without a large capital outlay.

More information? Circle Item 35 on postcard, page 136

Redesigned Motors Announced

A redesigned line of the Tri-Clad 55 single-phase capacitor motors featuring higher full-load speeds, higher overload capacity, and higher breakdown torque is announced by General Electric Co., Schenectady, N. Y.

These single-phase motors are part of the company's new series of motors, built to the latest rerated NEMA standards. The motors feature size reduction, a rigid cast iron construction, and incorporate a new insulation system, bearing assembly, and ventilation design. Starting of the motors is accomplished by a centrifugal mechanism which throws out when the motor is up to speed, disconnecting the starting capacitors and switching the windings from starting to running condition. The transfer switch is a totally-enclosed, snap-action switch with contacts protected from foreign matter to assure positive contact. A fibre terminal board is easily accessible behind a cover plate at one end of the motor. By reconnecting the leads, the motor can be changed from 115 volt 60 cycle to 230 volt 60 cycle operation, and by interchanging two leads, motor rotation can be reversed.

The single-phase motor is available in the standard, foot-mounting, and in vertical, D-flange and C-face, close-coupled pump, or resilient-base mounting. All of these, in turn, are available in either the standard dripproof enclosure or the totally-enclosed, fan-cooled enclosure for applications where the motor will encounter severe contamination or weather conditions.

More information? Circle Item 36 on postcard, page 136

Plastic Film Bars Moisture

The use of thin, tough, pliable sheets of plastic material called polyethylene film as a barrier against the penetration of moisture vapor is announced by Plastics Div., The Visking Corp., Terre Haute, Ind.

Applied to the warm side of exterior walls, over subflooring, underneath concrete slabs, or with crawl spaces, the lightweight film, made of Bakelite polyethylene resin, eliminates condensation and penetration of moisture into structures. Called Visqueen film, the product is claimed to last the life of the structure. It is a pure seamless plastic, chemically inert, and contains no plasticizer. Used under concrete slabs, the film eliminates the need for a gravel or stone base. It is laid over a layer of sand to protect it from ground projections and sharp objects. The film is noninflammable, that is, application of direct flame will cause the plastic to melt slowly, but it will not flash or support combustion. The film can also be used to make the floors and side walls of buildings air-resistant and dust-proof. Other uses for the product are waterproofing of shower stalls, flashing around windows, doors, and other openings, as a termite shield, a form liner and cover for the slow curing of concrete and as a protective covering for machinery, equipment and materials on the site of a job.

The film has high tensile strength, will not shatter when punctured, and will not split or run at either low or high temperatures. The material is available in seamless sheeting up to widths of 16 ft in thicknesses from .002 to .020 inches. Its weight is approximately one pound per 30,000 square inches.

More information? Circle Item 37 on postcard, poge 136

Newly-Designed Incinerator

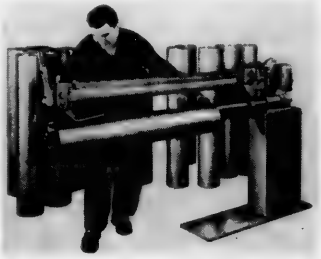
An incinerator of new design has been added to the selection of portable incinerators manufactured by Plibrico Co., Chicago, Ill. The basic design is suited to the incineration of all average dry waste. Modifications of the basic design are readily made for disposal of pathological waste, garbage, and other wet refuse. Capacity of three standard sizes ranges from 200 to 450 lb per hour.

Among this unit's features is an extra large door that simplifies charging bulky objects such as large boxes and cartons. This door is of the split-guillotine type, counterbalanced for effortless operation. Another feature is the long gas travel provided by the design, with numerous velocity and direction changes for high combustion efficiency. Still other features include a separate settling chamber, permanent steel skids, and a top stack outlet that shortens the overall stack length required. The stack, an optional item, is self-supporting. This incinerator has a steel casing for durability, and monolithic refractory lining.

More information? Circle Item 38 on postcard, page 136

Power Groover Closes Lock Seams

A power groover built for closing both single lock seams and Pittsburgh lock seams, and equipped with interchangeable horns and rolls, is introduced by Niagara Machine & Tool Works, Buffalo, N. Y.



With a nominal working length of 48 inches, the groover is equipped with adjustable stops to hold work stationary on the horn. Rolls are mounted in swinging cradles to permit front roll engagement on outstroke and rear roll engagement on return. Adjusting wheels enable close regulation of roll pressure to conform with thickness of material. The single lock seaming horn can be easily rotated and locked in any one of three positions for grooving inside seams or turned to flat side for grooving outside seams. Widths of grooves in the rolls and horn for single lock seaming are 3/8, 1/2, and 5/8-inch, while the horn for Pittsburgh lock seaming has a 7/16-inch groove width.

More information? Circle Item 39 on postcard, page 136

Add to Space Heater Line

Two models of oil space heaters have been added to the line of Perfection Stove Co., Cleveland, Ohio. The units have been designated Models H-819-F and H-818-F, the first a 65,000 Btu per hr heater, the second a 63,000 Btu per hr unit. Both units feature Monterey Tan front panels with the rest of the unit finished in a light leather tone mahogany.

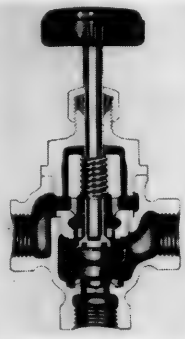
The Model H-819-F is designed to heat four to six rooms and incorporates the company's Dynadraft, which supplies its own draft to the chimney regardless of unfavorable factors which would affect natural draft. It also has automatic blower control and the company's Midget Pilot and Multi-Heat Burner. Extra large doors swing open at the sides for maximum heat production. Both units are Lo-Boy heaters. The Model H-818-F also incorporates the Midget Pilot, Multi-Heat Burner, and oval combustion chamber.

Both units can be operated automatically by using an automatic thermostat which is available as an accessory. Other accessories include the company's Floor-Flo Blower, an attached reservoir for use in place of an automatic oil supply, and a fuel pump, for use when the storage tank is lower than the heater.

More information? Circle Item 40 on postcard, page 136

Three-Way Output Control Valve

A three-way valve to control output of individual room units without overloading the pump is announced by Ohio Brass Co., Mansfield, Ohio. It can be used on forced circulation central heating and air conditioning systems or wherever water temperature or flow must be regulated.



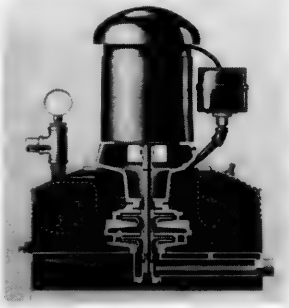
The valve body is cast in bronze alloy and has parallel, double-seat construction. It has one inlet and two controllable outlet ports. The valve is available in either ⅜ or ½-inch pipe size and can handle 300 pounds of water pressure at 425 deg F.

Total flow can either be channeled through the unit, partially by-passed in predetermined amounts, or completely by-passed. Volume of flow does not change; therefore, there is no extra load on the pump motor.

More information? Circle Item 41 on postcard, page 136

Pump Boosts Water Pressures

A pressure booster pump for boosting low water pressures for city dwellers is placed on the market by The Deming Co., Salem, Ohio.



Called the Cushionette, it is installed by connecting the suction pipe of the pump to the city line and the discharge pipe of the pump to the house line. When the water pressure in the city line falls below a minimum, a pressure switch starts the booster pump automatically. The pump keeps the pressure at the desired maximum while water is being used. The pump cuts out automatically when not needed to maintain the desired pressure. A feature of the pump is an extra-heavy rubber air tube located inside the tank which provides a positive air cushion at all times without the use of an air pump or an air control.

The unit includes the two stage, vertical type, centrifugal pump; a ⅓ hp capacitor motor with thermal overload protection; air cushion tube enclosed inside the pressure tank; and automatic pressure switch. The complete unit is 16 inches in diameter (tank) and 21 inches high. All working parts are fully enclosed, for protection against bodily injury.

More information? Circle Item 42 on postcard, page 136

Dust Control for Power Plants

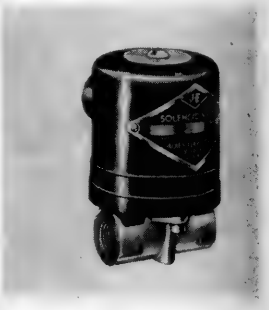
A new tool for fighting cities' air borne dust at the source has been developed by American Air Filter Co., Inc., Louisville, Ky.

Called the Amerclone, the development is a compact dry collector for granular dust which eliminates flyash from coal-burning power plants and the larger granular dust particles that settle in the neighborhood of rock crushing and bulk chemical plants. Looking much like an Army rocket-launcher, the device is made up of conical-shaped gray iron tubes that give the air a tornado-like twist, throwing the larger dust particles to the outside, while the clean air goes straight through. Because of this straight through air flow design, the units can handle widely fluctuating air volumes and dust concentrations with almost constant efficiency. This makes them particularly effective in eliminating flyash when boilers blow off.

More information? Circle Item 43 on postcard, page 136

Solenoid Valve in Thirty Models

A pilot operated solenoid valve in 30 different models for all sizes of line connections from ¼ to 1½ inches is available from Controls Div., Jackes-Evans Mfg. Co., St. Louis, Mo.



A feature of the valve is the use of the same coil assembly on all numbers, thereby simplifying service problems and reducing replacement parts inventory. Designed for use with Freon 12 and 22, water, air, gas, brine, ammonia, and oil, the valve has a synthetic rubber (nylon reinforced) diaphragm that is claimed by the manufacturer to be immune to almost any flow material. Replacement diaphragms are available. The units are available for either a.c. or d.c. operation. Bodies are supplied for screwed, sweat, or flanged connections. The valves can be installed in either horizontal or vertical lines and do not require careful positioning for proper functioning. All models have maximum differential pressure rating of 250 psi.

More information? Circle Item 44 on postcard, page 136

Woven Glass Fiber Tubing

A woven fiber glass tubular sleeving which cannot be stretched under tension and will not lose its tubular shape when filled or pulled is placed on the market by Hess, Goldsmith & Co., New York, N. Y.

Available in flat widths of from one to six inches and in continuous or cut lengths according to specification, the tubing is expected to find application in the electrical, home appliance, heating and air conditioning industries. The tubing is produced in two weave patterns, taffeta and crowfoot satin. The tubing will not shrink or rot. It is sun and heat resistant, unaffected by weather or humidity and will not absorb water.

More information? Circle Item 45 on postcard, page 136

(*Continued on page* 126)

Says **William H. Bodendorf, Pres.**
WILLIAM H. BODENDORF & SONS
Westfield, Mass.

"IN MY EXPERIENCE
RADIANT PANEL HEATING WITH
COPPER WATER TUBE
IS THE MOST EFFICIENT AND ECONOMICAL
WAY TO HEAT A HOME"

Mr. Bodendorf has been in the heating business for 30 years and in the radiant heat field for 9 years. He prefers radiant panel heating, using copper water tube, to all others. Here's why:

"Heat is distributed more evenly . . . there are no hot and cold zones, no drafts, so radiant panel heating is healthier. Also, it permits greater latitude in room arrangement, and more usable space. There is less cleaning and decorating to do than with conventional heating systems, while operating costs are invariably less.

"From my standpoint as a contractor I prefer Revere Copper Water Tube because it is easy to bend and handle . . . its long 60' lengths require fewer fittings and the solder fittings used eliminate the need for welding, wrench work and thread cutting. And most important; Revere Copper cannot rust so it keeps me out of trouble, helps build my reputation for quality work."

That Mr. Bodendorf has a reputation for quality work is attested to by the fact that of the more than 550 radiant panel installations he has made, he has never received a single complaint.

You, too, can keep out of trouble with Revere Copper Water Tube. Use it for radiant panel heating, hot and cold water lines, underground service lines, air conditioning and processing lines, waste stack and vent lines. There is a Revere Distributor near you who carries a full supply of Revere Copper Water Tube in various sizes and tempers. And if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

ONE BIG FEATURE of Revere Copper Water Tube is that Radiant Panel Heating coils are readily prefabricated in the shop. Time is saved, working conditions are more ideal, installation costs are cut. BODENDORF & SONS get their Copper Water Tube needs through the Revere Distributor, WARNER SUPPLY COMPANY, Westfield, Mass.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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•

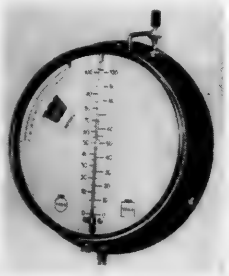
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

(*Continued from page* 124)

Volume Meter Has Mercury Column

A volume-meter that can be used without re-graduating on tanks of any size up to 11 feet diameter (or height) and with liquids of any specific gravity from 0.65 to 1.0, is being marketed by Way, Wolff and Associates, Inc., New York, N. Y.



Called Gallo, the meter reading is made by giving a few strokes to the pump atop the meter until the rising mercury stops climbing. Then mercury height is read on left side of the tube if tank is circular and on right side if tank is rectangular, or if it is a standing cylinder. The reading expresses liquid volume in percent, which is easily read as gallons from the conversion table that accompanies the meter. Mercury tube is radially adjustable from vertical to plus 30 deg inclination, with settings made according to an index scale at edge of the meter's face. A change in tank dimensions or in specific gravity of the liquid measured requires only a new setting of the index scale. The meter works as an open mercury manometer, connected to the bottom of the tank by a small pipe. Pressure of liquid in the tank depends on depth and specific gravity of the liquid. The pumping brings in air until air-pressure in the pipe is equal to pressure of the liquid (it cannot become larger) and this pressure is transmitted to the manometer. An automatic cut-off prevents damage to the meter through overfilling of the tank.

A high degree of accuracy is obtained when the meter is connected to the bottom of the tank, but for less accurate readings in ground tanks or where one meter is needed to serve a large number of tanks, the tube can be sunk into the tank through the opening.

More informatio?n Circle Item 46 on postcard, page 136

Air Conditioner for Residences

A three horsepower, water-cooled residental air conditioner that attaches to existing ductwork and is controlled automatically by the heating thermostat is placed on the market by Mitchell Mfg. Co., Chicago, Ill.

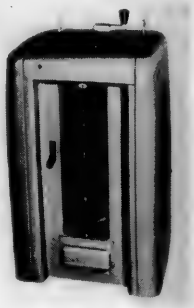
The air conditioner includes a hermetically sealed compressor with hydraulic expanding evaporator tubes for greater heating transfer. A water-cooled condenser provides high efficiency at minimum water costs. The entire unit is compact, measuring 22 by 20 by 62 inches, and includes a blower wheel, fan, and plenum chamber. The residential unit includes its own blower fan so that the heating system of the home does not have to be unbalanced, in order to adequately take care of the extra volume of air of a summer air conditioner.

More information? Circle Item 47 on postcard page 136

Industrial Welder Line

A complete line of low maintenance, high speed, a.c. Bumblebee welders is available from Air Reduction Sales Co., Division of Air Reduction Co., Inc., New York, N. Y.

The welders, NEMA rated 300, 400, and 500 ampere models, feature stepless current control, silicone insulation, and aluminum coil windings. The units are equipped with a large current scale, which the operator can read from a considerable distance without returning to the welder. The manufacturer states that fingertip current adjustment and quiet operation are made possible by a feature in which the coil supports float in a special rubber bushing.



The welders utilize the moving primary coil design and a log-arithmic current scale which has wider calibrations in the lower ranges. Current adjustments are accomplished by raising and lowering the primary coil. Wide current ranges on the welders (38-375 on the 300 amp model, 52-500 on the 400 amp model, and 65-625 on the 500 amp model) permit them to be used on many industrial applications ranging from light duty, low current, to heavy-duty, high current welding jobs. The manufacturer states that the units are particularly well suited to heavy section welding where high current is desirable and when arc blow would otherwise cut welding speed and quality.

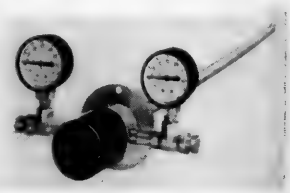
Optional equipment includes an automatic hot start which provides an extra surge of current for easier starting, arc stabilizing capacitors, power factor capacitors, primary switch, and a voltage reducing control and louver canopy for adaption to outdoor applications.

More information? Circle Item 48 on postcard, page 136

Pneumatic Temperature Control

An inexpensive non-bleed pneumatic temperature control is available from The Powers Regulator Co., Skokie, Ill., for operation of such devices as diaphragm valves, damper motors and other types of control equipment.

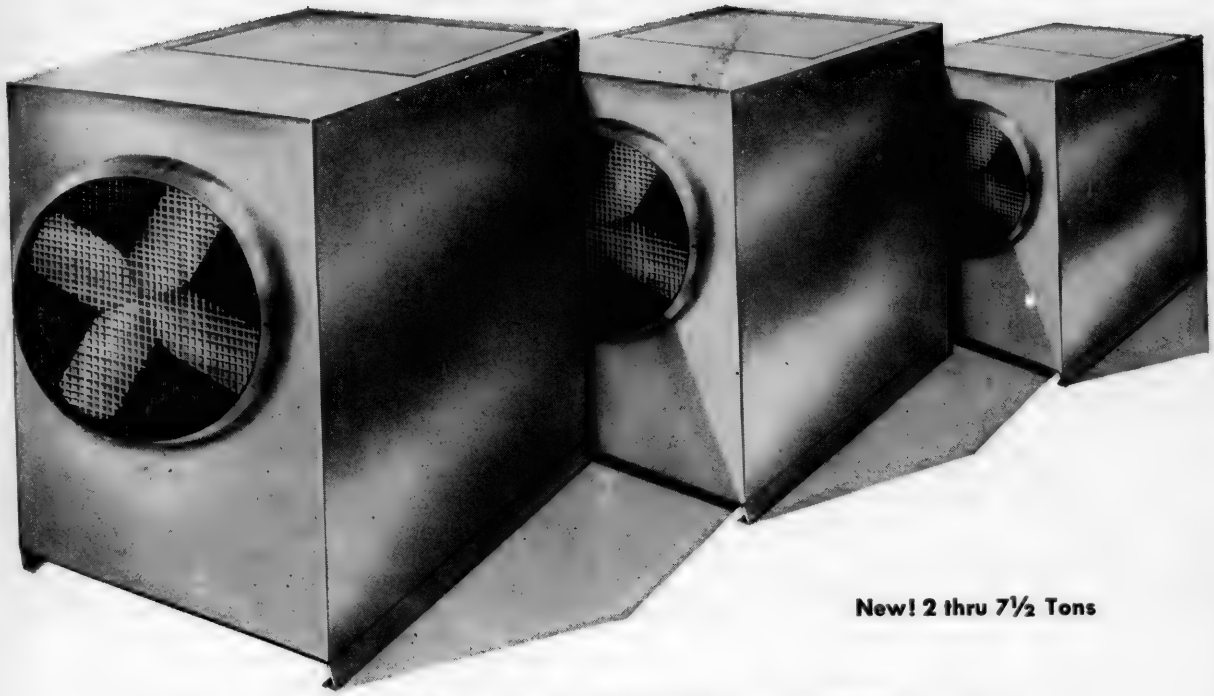
Known as the Limitem, the control is of the differential expansion type designed for regulation of heating, cooling, ventilation, air conditioning, dew point control, and industrial processes. The temperature range of the control is from 35 deg to 135 deg F. The graduated dial is concealed and the sensitivity can be adjusted from ⅛ to 2 psi per one deg temperature change, gradual acting. The body has 1¾-inch O.D. and averaging bulb length 18 inches with ⅜-inch pipe or flange connection. The control is available with direct action only. Design of the control is such that passage of air pressure is increased as the temperature rises.



More information? Circle Item 49 on postcard, page 136

(*Continued on page* 128)

RESIDENTIAL COOLING TOWERS



New! 2 thru 7½ Tons

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE

PRICED FOR THE HOME MARKET

Price-wise these Halstead & Mitchell Residential Cooling Towers throw open huge segments of the home and small building market to air-conditioning. Here is the development for which the industry has been waiting. Check prices today!

NOW REQUIRED IN MANY AREAS

Residential Cooling Towers recirculate precious water . . . meet requirements of municipalities which prohibit wasting cooling water to sewers. And low cost H&M units take residential air conditioning to the suburbs and rural area . . . recirculate from a cistern if need be!

MADE FOR REAL OPERATING ECONOMY

Economical, lastworthy . . . low operating cost matches low initial cost. Efficient gravity-type distributing pan eliminates windage loss since atomizing by spray nozzle is unnecessary. Low pump head pressure is another bonus of gravity distribution. And maintenance is a snap!

FAMOUS HALSTEAD & MITCHELL QUALITY

Here's *all* the quality for which Halstead & Mitchell Cooling Towers are world famous — including the 20-year Guarantee on the wetted deck surface of pressure-treated creosoted wood, against attack by rotting or fungi growth. Stainless steel fans and shafts, plus individual cabinet coatings of Vinsynite, Vinyl Zinc and chlorinated rubber add important years of life. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service.

AT LEADING WHOLESALERS EVERYWHERE

Write for descriptive bulletin from Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers, and Cooling Towers up through 100-tons.

HM Halstead & Mitchell

OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.

(*Continued from page* 126)

High Velocity Unit Heater

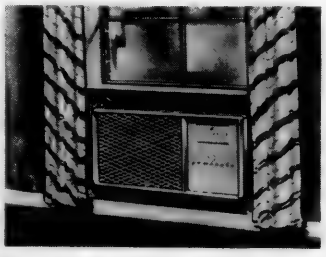
A Power-Throw unit heater designed to provide a powerful horizontal discharge of heated air has been placed on the market by Modine Mfg. Co., Racine, Wis.

The heater is particularly adaptable for use in large plants and warehouses. When machinery or other plant equipment impedes air delivery of the standard units, its powerful action provides the desired penetration and diffusion of heated air. The unit also can be used to blanket large, frequently opened doors with a curtain of heated air. Available models have capacities of from 271,200 to 609,600 Btu per hr. Weight of ten available models ranges from 128 to 284 lb. Five of the sizes are standard temperature units and five are low outlet temperature units designed for use with high pressure steam, where it is desired to maintain low outlet air temperatures. Adjustable louvers for directing the heated air output are standard equipment.

More information? Circle Item 50 on postcard, page 136

Room Cooler Is Set in Wall

The production of a new type of built-in air conditioning unit is announced by the recently formed Tywel Corp., Brooklyn, N. Y. The unit, which fits into the wall like a radiator, will be manufactured exclusively for builders of apartment houses, motels and private homes.



Measuring about 18 x 30 inches, the units are approximately as deep as the thickness of a building wall. The unit eliminates the half-opened window required for the conventional window type unit. Inside the room, the unit appears as a radiator grill, with practically no part of it penetrating into the room and clashing with the decoration. The units will be manufactured in various capacities, according to the sizes of the rooms to be cooled. Each unit is individually controlled.

More information? Circle Item 51 on postcard, page 136

Mixture Makes Heat Conductor

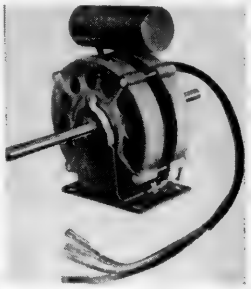
A mixture of powders and a liquid which form a thermal conducting material is being marketed under the trade name of Tracit by the newly-formed Chemax Mfg. Corp., New Castle, Del.

The product is a ready-to-apply, mortar-like material which is self-hardening, and when set, is highly resistant to mechanical and thermal shock. The manufacturer states that it has good heat conduction and is useful in conducting heat between surfaces, usually irregular in shape. Due to its adhesiveness, the material is applied to surfaces by hand or with a trowel. After setting by drying, either in air or forced drying, the material bonds strongly to a surface. The manufacturer suggests that application over traced pipe, valves, or other equipment where it is desirable to maintain a constant temperature by the addition or subtraction of heat, as well as application to floors of radiant heated homes or plants where good distribution of the heat in the tubing is desired, are possible uses for the new material.

More information? Circle Item 52 on postcard, page 136

New Motor for Air Conditioners

A motor for air conditioners, which the manufacturer claims eliminates the faults common to shaded pole motors is placed on the market by Howard Industries, Inc., Racine, Wis.

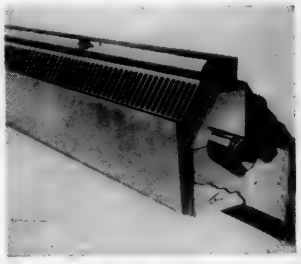


The motor, a split capacity type, is called the Model 6000 and has a horsepower rating of 1/12 for air conditioning units ranging from ¾ to 1½ tons. The unit features Life Time oiled bearings that the manufacturer claims permit the unit to operate at an average temperature of 20 deg C. The unit also incorporates other specific features for which patents have been applied that the maker claims to be unique to the motor industry.

More information? Circle Item 53 on postcard, page 136

Radiator Has Inside Turbulator

An inside turbulator extending the entire length of the steel pipe is featured in the 1955 line of baseboard heating units of the Union Asbestos & Rubber Co., Chicago, Ill.



The manufacturer states that the turbulator eliminates the possibility of a core of hot water reducing efficiency. The turbulator mixes the water thoroughly as it passes through the pipe, insuring uniform temperature of all the water in a given section. Features are five-sided fins which provide evenly distributed heat, and louvers designed to direct the flow of heat away from the walls to avoid unsightly streaking. Sliding type dampers are operated from a knob in the center of each damper section. The entire front panel, which is designed to snap into place, can be easily removed for cleaning or redecorating. Hangers support the heating element as well as the one piece cover. Wherever necessary, the parts are hot-dip galvanized.

More information? Circle Item 54 on postcard, page 136

(*Continued on page* 130)

BARBER COLMAN

"UNI-FLO" ENGINEERED

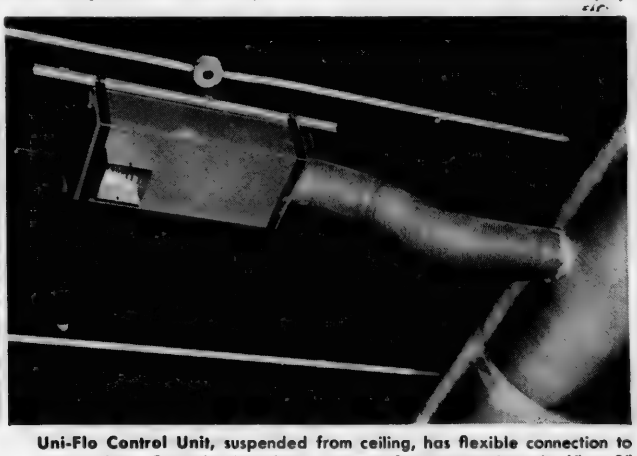
Air Distribution

. . . at Hudson's in Northland Center

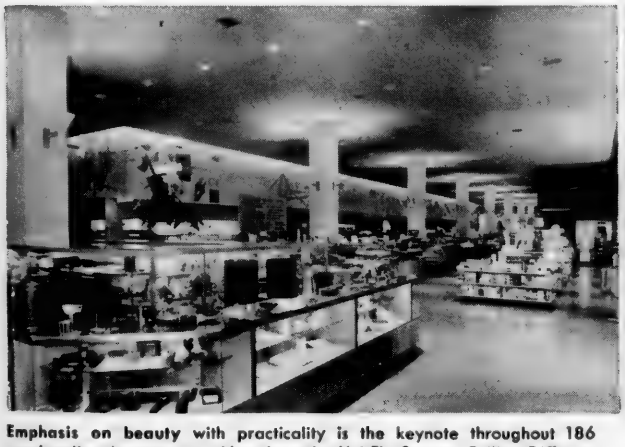
Close collaboration between consulting engineers, architects, store executives, air conditioning contractor, and the Barber-Colman laboratory staff has brought about one of the world's largest shopping center installations . . . at The J. L. Hudson Company's massive new branch store in $25,000,000 Northland Center, Detroit, Hudson's basement alone covers 18 acres, and the enclosed floor area totals 486,205 square feet. The entire store is air conditioned including selling areas, restaurants, lounges, offices and service departments.

Architects and Engineers: Victor Gruen Associates, *General Contractor:* Bryant & Detwiler Co.; *Air Conditioning Contractor:* Carrier Corporation; *Mechanical Contractors:* Donald Miller Company

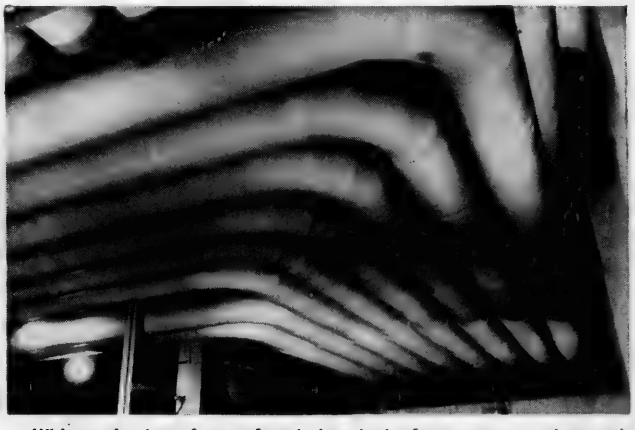
Contemporary design prevails throughout the world's largest suburban department store, exemplified by this view taken from the West Terrace. Complete edifice is air conditioned the year 'round for shopping comfort.



Uni-Flo Control Unit, suspended from ceiling, has flexible connection to branch duct. Control unit reduces pressure from approximately 6" to 8" H_2O down to low pressure for efficient distribution through diffuser.



Emphasis on beauty with practicality is the keynote throughout 186 merchandise departments. Note how the Uni-Flo Square Ceiling Diffusers blend harmoniously with the acoustical ceiling.



Wide angle view of part of trunk ducts in the fan room, connecting to air shaft at rear. Nearly eight miles of duct-work are required to carry conditioned air for just the first two floors.

BLAZING THE TRAIL *TO BETTER AIR DISTRIBUTION*

First with complete laboratory facilities . . .

When Barber-Colman entered the air distribution field nearly 20 years ago, laboratory facilities were established to simulate every possible condition of air distribution. From this laboratory has come reliable selection data . . . and many of the industry's pioneering developments.

Based upon years of laboratory research, plus field experience, Barber-Colman has the equipment and engineering "know-how" to help you design and install space-saving high velocity equipment for highly satisfactory results. Get latest data from our nearby Field Office (consult telephone directory), or write us. Our facilities and job-proved techniques are at your disposal.

BARBER-COLMAN COMPANY

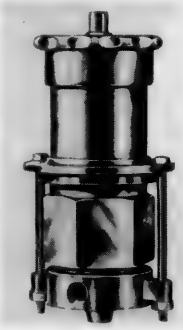
Dept. K. 1102 Rock St., ROCKFORD, ILL., U. S. A. Field offices in principal cities

Air Distribution Products • Automatic Controls • Industrial Instruments
Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

(*Continued from page* 128)

Reducing and Relief Valve

A high pressure combination reducing and automatic relief valve has been designed for low capacity applications by Atlas Valve Co., Newark, N. J.



The Type F reducing and relief valve can be used for initial pressures as high as 4000 psi and reduced pressures from 2000 psi down to zero psi in accurately controlled adjustable increments. This spring loaded, diaphragm operated combination valve can reduce high pressure air, oil or water and make these reductions down to set point without shock. The manufacturer states that it will not leak on tight shutoff, and variations in initial pressure will have little effect on the reduced pressure. The built-in relief valve automatically opens to relieve excess if reduced pressure exceeds setting. The valve is available in ⅛, ¼, ½ and ¾-inch sizes.

More information? Circle Item 55 on postcard, page 136

Suspended Unit Heaters

A horizontal suspended oil or gas-fired unit heater is announced by Universal Products Mfg. Corp., Auburn, Ind. The units are available in six models with Btu per hr ratings ranging from 90,000 to 450,000.

The units hang overhead and save floor space as well as piping and sheet metal costs. The flange mounted pressure burner, with 2-stage pump, lifts oil to unit and assures positive pressure. The unit incorporates an observation window for inspecting the flame. The precast refractory combustion chamber is factory installed.

More information? Circle Item 56 on postcard, page 136

Preheater for Bulk Tanks

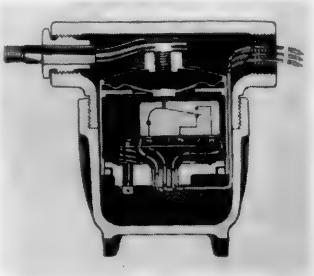
To solve the problem of preheating of fuel oil in the bulk tank, before it enters the suction line, Rempe Co., Chicago, Ill., has introduced a preheater called the Hot Spot. The unit is claimed to assure a constant supply of proper viscosity fuel.

The unit is an all-steel shell and coil assembly (no moving parts) that can be installed through the manhole of a bulk tank. It rests on the bottom of the bulk tank. Inlet and outlet pipes for heat (steam or hot water) and suction line go through the manhole cover. A flow accumulator causes the heavy oils or other liquids to flow over heated pipes before entering the suction line. The preheater is made in two sizes for 14½-inch manholes and for 16½-inch manholes and larger. It is custom built to meet individual requirements of diameter of bulk tank. No cutting or fitting on-the-job is required. Unit is completely tested with 400 lb air pressure under water after fabrication.

More information? Circle Item 57 on postcard, page 136

Pressure and Vacuum Switches

A group of explosion-proof pressure and vacuum switches is offered by Barksdale Valves, Los Angeles, Calif. The manufacturer states that the valves are unusually compact and repeat within ±1% of setting.

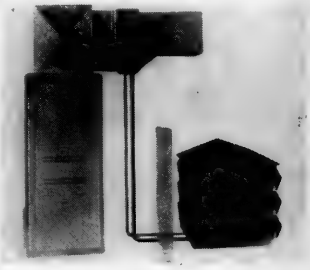


The valves are enclosed in an explosion-proof housing, UL approved for hazardous locations; Class I, group B, C, and D; Class II, group E, F, and G. These listings are for atmospheres containing vapors of ethyl, ether, gasoline, alcohol, acetone, petroleum naphtha lacquer, and solvents, as well as natural gas or grain dust. The switches in the group cover the range from 30 inches of mercury proof vacuum to 150 psi, sensing increasing or decreasing vacuum or pressure. Standard models are available for single or daul settings. The latter will secure two diffferent pressure limits and actuate two electrically independent circuits, one a.c. and the other d.c. if desired. The units are automatically reset by the snap action characteristic of the switches.

More information? Circle Item 58 on postcard, page 136

Air Conditioner Is Waterless

Waterless home air conditioners which the maker claims provide efficiency equal to water-cooled condensing units are announced by The Williamson Heater Co., Cincinatti, Ohio.



No water, sewer connections, water towers or pumps are required by the waterless air conditioners. As a result, the units are highly desirable for use in areas where water and sewer usage is expensive. Air instead of water is used as the condensing medium. Consumption of electricity is reduced for additional economy. The duct type, package and counter-flow air conditioners are available in 2, 3 and 5 hp sizes. A cooling coil is inserted in or connected to furnace heating pipes or ducts. Liquid and vapor lines run from the coil to the condenser. The air cooled condensing unit, located outdoors, is hidden conveniently among shrubbery. The counter-flow type takes no extra floor space since the cooling coil is installed under the counter-flow furnace. The compressors of the units are guaranteed for 5 years.

More information? Circle Item 59 on postcard, page 136

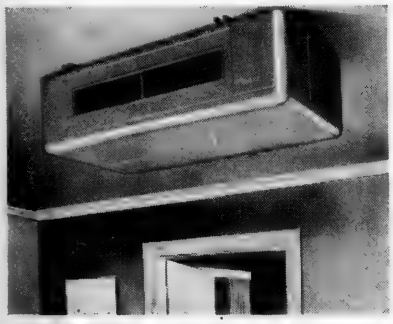
(*Continued on page* 132)

NOW — for low-cost, year 'round air conditioning of individual rooms

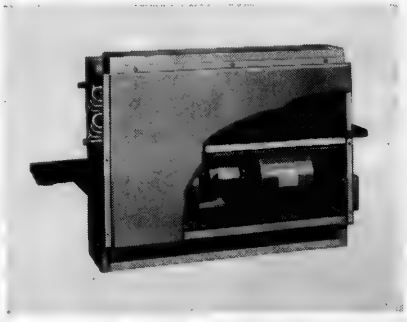
YOUR CHOICE OF 4 TYPES OF THE NEW

Modine Airditioner

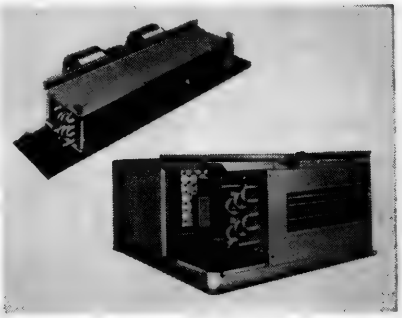
CONSOLE MODEL—superbly styled and finished—blends gracefully with any interior decor. Design facilitates recessing—only 6 in. need project into room. Also for free-standing installation.



CEILING MODEL — deluxe unit for exposed installation on ceiling—saves floor space.



CONCEALED MODEL (front panel cutaway) permits out-of-sight installation in wall.



OVERHEAD MODELS—with or without plenum and filter for use in furred space.

HERE'S low-cost cooling, heating, ventilating, filtering, dehumidifying and circulating of air for individual rooms. Ideal for hotels, offices, apartments, motels, hospitals and similar multi-room applications. AIRditioners* save cost of installing central duct systems in new buildings. On modernization jobs, they solve the difficult problem of providing supply and return ducts in existing walls.

Cold water from a central chiller or other source is piped to each unit for summer cooling. Heating is accomplished with hot water from a central heating plant. *The same piping* —water supply and return, and drain —serves each unit for both cooling and heating. And AIRditioners are *individually controllable.*

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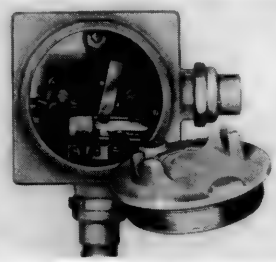
(*Concluded from page* 130)

Switch for Cooling Tower Fans

Production of the Dual-Safety Switch, a combination vibration cut-off and safety switch for cooling tower fans, is announced by Santa Fe Tank & Tower Co., Los Angeles, Calif.



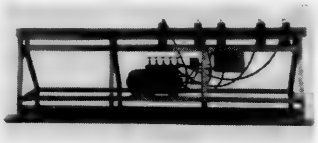
The manufacturer states that the switch prevents costly tower repairs resulting from blade breakage and equilibrium loss on fans. A mercury switch automatically stops a fan's electric current when vibration indicates trouble. The sensitivity of the switch is set by manual adjustment. The faulty fan cannot be started up again, except by resetting the switch, after maintenance is completed. In addition, the switch is said to aid safety for personnel working in the fan stacks, by eliminating accidental resetting by vibration or any person. The switch is operated from the cooling tower deck without entering the fan stack. Its fixed position on the gear supporting beam is aligned for instant reaction to any fan or driving shaft irregularity.

The company states that the device is attached to each fan on cooling towers of its own manufacture, and that the control can be utilized in any existing cooling tower.

More information? Circle Item 60 on postcard, page 136

Notcher for Ventilation Duct

A machine for gangnotching all necessary notches required in the fabrication of ventilation ducts using the government clip, bar slip or S and drive connections is placed on the market by Harper Metal Products, Ltd., San Bruno, Calif. Called the Speednotch, it is a self-contained portable machine.

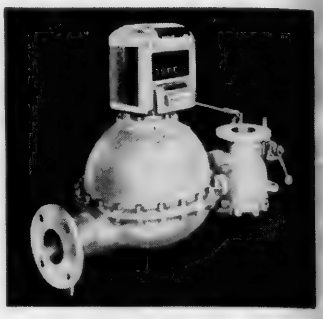


The manufacturer claims that less than 60 seconds time is required in sliding and locking the punches in their respective positions, ready for notching. Where in many cases only one or two joints of any size duct are required, the complete operation can be done in less time than a single pattern layout. All pattern layouts, scribing, center punching and hand notching have been eliminated. Each of five punches is equipped with shut-off valves or can be readily removed. This feature allows notching of various types of duct such as straight pipe fabricated from one or more pieces, heels, throats, cheeks or elbows or similar fittings, ranging from 3½ inches to and including 10 ft. Capacity is 18 gage mild steel. Sheets blanked to the correct size are set against the fixed gages mounted on the punches, and all five punches are simultaneously energized by a foot-operated floor switch. By turning the sheet over and repeating the operation, the material is ready for braking. The notches are used for points of braking.

More information? Circle Item 61 on postcard, page 136

Meter Controls Liquid Flow

Automatic control of water, syrups, solvents, oils, and other liquid ingredients fed to batching and blending processes is now extended to rates of flow as high as 300 gpm, with the announcement of a 3-inch Neptune Auto-Stop meter by Neptune Meter Co., New York, N. Y.



The meter features a double-trip or cushioned Auto-Stop valve that slows down the rapid flow of the liquid an instant before it trips shut. This permits accurate cut-off with no hydraulic hammer. To operate, the tripping mechanism on the register is first set by pushing the buttons on the bottom of the register until the number of gallons or pounds required by the formula shows up on the setting wheels in the little window just above the buttons. The main numerals are then cleared back to zero by turning the re-set handle on the right side of the register. After opening the valve, the operator is free to devote attention to other duties. The meter automatically cuts off the flow when the exact quantity of liquid is delivered. The large numerals on the face of the meter keep pace with the flow, and provide a visual check when the delivery is finished. Flow can be stopped instantly at any time by pressing the emergency stop button. This does not affect the meter reading or the Auto-Stop setting. The delivery can be continued to its conclusion by reopening the valve, or the register can be reset for a new quantity before continuing.

The meter is of the positive displacement, nutating piston type, of bronze construction.

More information? Circle Item 62 on postcard, page 136

Multi-Zone Air Conditioner

A multi-zone air conditioning unit which can supply the individual temperature and humidity requirements of as many as 12 zones in a building is available from Westinghouse Electric Corp., Boston, Mass.

The central plant unit maintains a comfortable temperature in various zones regardless of variations in building construction, changes in occupancy, wind or solar exposure. Of the blow-through type, the multi-zone unit forces air over either cooling or heating coils or a combination of the two according to the demands of the zones. The required air quantities and temperatures are regulated through the positioning of sets of interconnected hot and cold air dampers in the coil section discharge. Two non-overloading, backwardly-inclined blade fans operating in a pressure chamber constitute the fan assembly. The unit is available in seven sizes ranging from 1,665 to 21,000 cubic feet per minute.

While designed primarily for office, commercial and public buildings, the unit is equally applicable in large residences where individual zone control is required or desirable.

More information? Circle Item 63 on postcard, page 136

Galvanized Steel Costs Less than Sheets of Other Metals

Compare steel with any other sheet metal on the basis of equal strength and you will find that it costs substantially less. To equal the strength or stiffness of light-gage steel, other metals must be used in relatively thick and expensive gages.

If you compare steel with other metals on the basis of equal weight, again you will see that steel is less expensive. Pound for pound, no other commonly used sheet metal can match the low cost of steel.

Bethlehem galvanized sheets are made from strong, durable steel, either plain or copper-bearing. They carry a tight, uniform coating of zinc to provide superior corrosion-resistance. They look good. They have excellent workability, and they give a professional finish to any sheet-metal job.

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PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on:

• News of Equipment and Materials

or a copy of the following

• New Catalogs

Circle the item Numbers in which you are interested and print clearly your name and address with title.

NEW CATALOGS

PACKAGED LIQUID CHILLERS—For the man with the problem of specifying refrigeration and air conditioning equipment in the range of capacities from 15 through 220 tons, a new catalog on Flow-Therm packaged liquid chillers is made available by Acme Industries, Inc., Jackson, Mich. Included in the twelve models listed are units for one-compressor, single-circuit installations and others for dual refrigerant circuits.....Item 101

BULLETIN COVERS PRODUCT LINE—A revised product bulletin, PB-290, which contains a comprehensive index of the company's products in the heating, air conditioning, ventilating, and heat transfer field has been released by The Trane Co., La Crosse, Wis. The bulletin does not give complete data on each product, but discusses each briefly.....Item 102

DATA ON STAINLESS STEEL PIPING—Data of interest to engineers and designers associated with problems involving stainless piping are included in a bulletin, TB 356, published by Tubular Products Div., The Babcock & Wilcox Co., New York, N. Y. This bulletin outlines methods of bending and joining stainless pipe and discusses the problem of light wall versus heavy wall pipe. Also included are a table of dimensions and weights of various stainless pipe size schedules and condensed technical data on mechanical and physical properties of the more popular stainless steels used for piping.....Item 103

BULLETIN DESCRIBES PURIFIERS—An internal type purifier is described in a 4-page, 2-color bulletin, 103, published by The V. D. Anderson Co., Cleveland, Ohio. The folder contains dimensional drawings illustrating the use of purifiers inside two typical installations. The bulletin also has a cut-away drawing illustrating flow of vapor through the unit, a table of dimensions, specifications and a description of the operation of the unit.....Item 104

SOLENOID VALVE BULLETIN—A 16-page bulletin, 1010, covering a complete line of standard 4-way hand, foot, power and solenoid operated valves has been released by Ledeen Mfg. Co., Los Angeles, Calif. The bulletin also shows a new line of pilot valves. Dimensions and weights, application diagrams, circuit diagrams, parts list and accessories are also included in the bulletin.....Item 105

AUTOMATIC REGULATOR BULLETIN—A four-page, illustrated bulletin showing a selection of automatic regulators designed for use in the heating, power generating and industrial processing fields is made available by Atlas Valve Co., Newark, N. J. Eleven automatic regulating devices are pictured and described; among them precision high and low pressure reducing valves, relief and lever operated control valves, temperature regulators, standard and excess pressure pump governors, a super-sensitive pressure regulator and an air-actuated pilot. A decription of each unit covers in detail the maximum and minimum pressure limits, materials of construction, design features and applications.....Item 106

TURBINE PUMPS DESCRIBED IN BULLETIN—Turbine Pumps for Industry, is the title of an eight-page bulletin (No. 735-1) which describes and illustrates the latest models of vertical turbine pumps being manufactured at Pacific Coast Works, A. O. Smith Corp., Los Angeles, Calif. The bulletin shows characteristic curves and gives a detailed description of principal components. Typical applications are included.....Item 107

IMPREGNATION OF CASTINGS DESCRIBED—An eight-page, two-color brochure, MMC-048, illustrating modern casting impregnation, is available from American Metaseal Mfg. Corp., West New York, N. J. How this method achieves impregnation of porous castings is graphically illustrated in photographs showing the equipment used in batch immersion for the rapid treatment of large quantities of parts. Application to various metals is described. Special sections explain how impregnation reduces product rejects in both cast and metal powder parts. Tables give the properties of the company's impregnant, and the corrosives it will resist.....Item 108

PAINT AND LINOLEUM GUIDE—A 4-page paint and linoleum color selection guide has been made available to architects and engineers by Herman Nelson Unit Ventilator Products Dept. American Air Filter Co., Inc., Louisville, Ky. Designed primarily for persons interested in unit ventilators, auxiliary cabinets and convectors for school classrooms, the 5-color brochure covers a wide range and selection of different colors. Linoleum reproductions are in full color while the paint samples reflect a new lacquer transfer method. Seven different colors and four combinations of colors are shown for Herman Nelson classroom equipment. The Linoleum which is used on unit ventilators, cabinets and convectors is shown in five different choices of styles. Other features of the color and selection guide include suggestions for color combinations, and reflectance factors.....Item 109

BULLETIN ON DUST CONTROL—How to control dust in the various segments of the ceramic industry is discussed in a bulletin No. 482, published by American Wheelabrator & Equipment Corp., Mishawaka, Ind. This bulletin, titled How To Save Money In 1954, is applicable to people like manufacturers of enamel ware, pottery, silica brick, refractories, whiteware, glass, insulators, and various ceramic structural products. It gives case histories of four different companies showing how dust conditions due to grinding, screening, mixing, classifying, elevating, and packaging operations are prevented as a result of using local exhaust ventilation in which Dustube cloth-tube-type dust collectors are employed.....Item 110

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CATALOG ON PROPER EXHAUSTER—A bulletin which contains detailed information and performance tables regarding its Gyra-Flo power exhausters, is issued by Chicago Blower Corp., Chicago, Ill. In addition to the detailed description, the bulletin contains a cutaway view and line drawing of the exhauster, as well as a sample specification.....Item 111

BULLETIN ON CONDENSERS, COOLERS—An illustrated bulletin, 123, which covers its condenser and fluid cooler of Aeropass design is issued by Niagara Blower Co., New York, N. Y. The bulletin illustrates the unit with photographs and a flow diagram, gives physical and operating characteristics, and lists applications of the unit.....Item 112

BULLETIN DESCRIBES POWER GROOVER—Illustrated Bulletin 74-B, published by Niagara Machine & Tool Works, Buffalo, N. Y., presents its Model 42-U Universal Power Groover. Included with detailed information and specifications for this machine are step-by-step illustrations of both single and Pittsburgh lock seaming. Also shown and described are several other Niagara machines available to meet a wide range of grooving and seaming requirements.....Item 113

FLEXIBLE HEATING ELEMENT—An eight page catalog on Heatflex electrical heating elements has been released by Continental Electric Equipment Co., Cincinnati, Ohio. The catalog contains descriptive material, applications, and engineering data.....Item 114

BULLETIN ON RUST-PREVENTION—A brochure which describes their rust-inhibiting primer, Ospho has been published by Rusticide Products Co., Cleveland, Ohio. The bulletin claims there are definite savings when this metal primer is employed in a maintenance program. It is not necessary to remove tight rust; no sandblasting or flame cleaning is necessary, the product is applied directly over rust by brush, swab or spray. Paint jobs are said to last longer with savings in application time.....Item 115

REFRIGERATION PRODUCTS CATALOG—Publication of a catalog of refrigeration products, R-300, is announced by Kramer Trenton Co., Trenton, N. J. In addition to product photographs, dimensional tables, capacity ratings, shipping weight information and other pertinent information, this new catalog includes complete rapid selection tables for both high and low temperature application.....Item 116

HOT WATER HEATING LITERATURE—Two pieces of literature on hot water heating have been published by C. A. Dunham Co., Chicago, Ill. A hot water catalog, No. 1551, contains photos, application drawings and all necessary catalog information on the campany's line of hot water equipment including circulators, valves, fittings, specialties and controls. The second publication, a two-color consumer brochure entitled There Are Two Sides To Every Story, is actually an educational booklet designed to help contractors sell consumers on the advantages of hot water baseboard heating with an automatic indoor-outdoor thermostat controlling the system.....Item 117

BULLETIN COVERS COOLING TOWERS—Bulletin 312, covering its complete line of standard atmospheric spray cooling towers is available from Binks Mfg. Co., Chicago, Ill. This 12-page bulletin contains simplified selection tables for determining correct tower sizes. All the engineer has to know is the refrigeration load and the cooling range and design wet bulb conditions. The tables do the rest. The bulletin also includes full information on the construction details of the company's Type H and T atmospheric towers, including over-all dimensions and weights required.....Item 118

BACK PRESSURE VALVE CATALOG—A catalog designed to be a text on the application of its Wolf-Linde line of back pressure valves for air conditioning, liquid cooling, and special installations requiring control of evaporator pressure is published by Dersch, Gesswein & Neuert, Inc., Chicago, Ill. Helpful instructions are offered in the catalog for selection of the right size and type of valve for each specific application. The catalog also contains information on the effective installation of controls.....Item 119

BULLETIN ON SOLENOID CONTACTORS—A 6-page solenoid contactor bulletin, SC-8, issued by Guardian Electric Mfg. Co., Chicago, Ill. features a wide range of enclosed and sealed models with power ranges up to 250 amperes. The bulletin is fully illustrated, includes dimensional drawings and complete technical data. Included are military specification numbers, type numbers and specific approval information.....Item 120

1954-55 CATALOG ISSUED—A 1954-55 catalog has been issued by Lima Register Co., Lima, Ohio. It describes the company's line of floor, wall, baseboard and ceiling diffusers, registers and grilles for heating and cooling. Included in the 28-page catalog are engineering data, performance figures, specifications and diffusion pattern photographs, and a Btu conversion table. Unretouched full color photographs of actual diffuser installations are included.....Item 121

PIPE LINES FOR FUEL TRANSPORTATION—Bulletin FL-1, issued by Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., discusses the problems involved in transporting liquid petroleum products through pipe lines. First in a series, the bulletin describes in general terms, a typical pipe line system, the variables to be measured, and pipe line control problems.....Item 122

PIPE INSULATION FOLDER—A four-page brochure on its low-temperature pipe insulation, Vapo-Wall, is issued by MMM, Inc., Houston, Tex. This illustrated folder provides a complete picture of the product's insulating properties as well as helpful recommendations on how to apply this pipe covering.....Item 123

RELIEF VALVE CATALOG—A catalog folder containing data on temperature and pressure relief valves for domestic hot water storage tanks is released by The Patrol Valve Co., Cleveland, Ohio. Contents of the folder, which incorporates a tab for handy file reference, includes new catalogs on the company's Standard Series and 60 Series relief valves, as well as catalogs on their diaphragm, self-closing (automatic) and 40 Series relief valves, and safety valves.....Item 124

BASEBOARD RADIATION CATALOG—A catalog which has a new method for figuring both heating and cooling installations as the main feature is issued by Gerwin Industries, Inc., Michigan City, Ind. Complete capacity tables are given for various climatic conditions. The book is profusely illustrated and makes an ideal sales tool for the dealer to use. One feature is a comparison table of relative advantages and disadvantages of four different types of heating systems. Complete installation instructions for the company's line of baseboard diffusers are also illustrated and described.....Item 125

CATALOG DESCRIBES CONVECTOR LINE—A 22-page catalog, describing its line of convectors is published by Airtherm Mfg. Co., St. Louis, Mo. The booklet contains detailed descriptions, photos, specifications, construction and application information on the company's convectors. Tables and charts show the capacities of the various models.....Item 126

COMBINATION FILTER AND DRIER—A bulletin describing and illustrating its improved Model 410 Trap-Dri, a combination filter and drier, is issued by A-P Controls Corp., Milwaukee, Wis. The catalog furnishes dimensions, installation data, construction features, application information, and a listing of all types in the new design.....Item 127

SELECTION GUIDE ON VENTILATING EQUIPMENT—A complete guide to selection of propeller fan type ventilating equipment is offered by Ilg Electric Ventilating Co., Chicago, Ill., in a 36-page catalog, No. 151, just published. Specifications and other installation data are offered on propeller fans in portable, kitchen, tube-axial, centrifugal, home cooling, roof ventilator and other types. Detailed illustrations of construction features accent design and performance characteristics. Case study photographs picture a wide variety of installations.....Item 128

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63							
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128		

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What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

SUFFICIENT water flow must be allowed for each of the type of plumbing fixtures that is installed in an industrial building when computing the total water demand. While there is a definite flow per fixture, this water flow is influenced by the operation of a group of fixtures and also when there are groups of fixtures in scattered areas.

This Month's Problem

I am trying to obtain figures used by piping designers which would give the water demand for various plumbing fixtures installed in a factory. This information should cover both the water demand for fixtures installed singly and in groups.

Figures presented on plumbing fixture water demand are in answer to a question submitted by a plant engineer. Should you have a problem that you would like to see discussed in this department, or if you have some comments that you would like to add to the discussion scheduled for the following issue, you are invited to write to the Editor. Such letters are always welcome.

This Month's Problem

Computation for water requirements are generally based on tables of requirements for individual fixtures which allow reasonable time for filling these units, and reduction factors on these allowances per fixture when there are two or more fixtures. These reduction factors are arbitrary and are based on the experience and judgment of engineers and contractors who have had extensive experience in this class of work.

Table 1 lists commonly accepted quantities of water required per individual fixture normally in use in industrial buildings. For groups of fixtures in simultaneous operation, the water requirements are given in Table 2.

If there are two or more groups of fixtures located on various floors or scattered areas in the building, the total demand on the system will be modified in accordance with the figures given in Table 3.

Short branch connections to individual fixtures or to groups of fixtures in a toilet room may be sized on the basis of a pressure drop of not more than 30 psi per 100 ft, and long branch supplies and mains at pressure drops which will insure a pressure of not less than 15 psi at the highest and most distant fixture under maximum design flow conditions in the main and branch piping.

The hot water requirements for the sanitary facilities of an industrial building will normally be very light ex-

(*Concluded on page* 169)

TABLE 1—WATER DEMAND OF PLUMBING FIXTURES

Fixtures	Water Demand, Gpm
Lavatory	4
Wash fountain	5
Wash sink	4
Service sink	15
Shower bath	5
Drinking fountains	1
Water closet with 1 inch flush valve	30
Water closet with low tank	5
Urinal with 1 inch flush valve	30
Urinal with ¾ inch flush valve	25

Problem for the Next Issue

Part of a large floor at our plant is to be walled off and partitioned into offices. Across the corridor from one of the offices will be the room in which will be a large centrifugal fan, filters and coils of an air conditioning system. Fears have been expressed that fan noises will be communicated to nearby offices. Are there any rules to follow, either in fan selection or installation, that will reduce or eliminate the noise hazard?

TABLE 2—WATER DEMAND FOR GROUPS OF FIXTURES

Fixtures	Number of Fixtures								
	1	2	4	8	12	16	24	32	40
	Water Demand, Gpm								
Water closets and urinals with 1 inch flush valves	30	50	80	120	140	160	200	250	300
Urinals with ¾ inch flush valves	25	37	45	75	85	100	125	150	175
Lavatories and wash sinks	4	8	12	24	30	40	48	64	75
Shower baths and wash fountains	5	10	20	40	60	80	120	160	200
Service sinks	15	25	40	64	84	96	120	150	200

Air Conditioning Requirements Halved

IN THIS modern skyscraper, the air conditioning system is only about half the size of the conventional system. Dorex Air Recovery makes this important saving possible.

Dorex Air Recovery is a simple method by which used air can be "reconditioned"—made completely odor-free and fresh for reuse. This sharply reduces the amount of outside air that has to be taken into the system and thus reduces the size of heating and cooling equipment required—effecting important savings on original investment and in operating costs over the years.

In fact, averages—drawn from more than twenty years' experience with over 10,000 Dorex installations—show that every $100 invested in Dorex Air Recovery should return about a $400 saving in original ventilating equipment...and every $1 spent for Dorex maintenance should save some $4 in operating costs.

Mail the coupon today for full information about Dorex Air Recovery. Connor Engineering Corporation, Danbury, Connecticut.

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dorex®

air recovery

CONNOR ENGINEERING CORP.
Dept. B-114, Danbury, Conn.

Please send me, without obligation, full information on Dorex Air Recovery.

Name _____

Position _____

Company _____

Street _____

City _____ **Zone** _____ **State** _____

DEGREE-DAYS FOR SEPTEMBER, 1954

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 27th Year of Publication of Monthly Degree-Day Data

City	September			Season to Sept. 30, incl.*		
	1954	1953	Normal	1954-55	1953-54	Normal
Abilene, Texas (A)	0	4	5	0	4	5
Albany, New York (A)	157	165	139	157	165	139
Albuquerque, New Mexico (A)	3	0	13	3	0	13
Alpena, Michigan (C)	205	237	183	205	237	183
Anaconda, Montana (C)	(a)	194	335**	(a)	194	335**
Asheville, North Carolina (C)	14	51	50	14	51	50
Atlanta, Georgia (A)	0	0	8	0	0	8
Atlantic City, New Jersey (C)	16	26	29	16	26	29
Augusta, Georgia (A)	0	0	0	0	0	0
Baltimore, Maryland (C)	25	28	29	25	28	29
Billings, Montana (A)	174	112	194	174	112	194
Binghamton, New York (C)	125	139	141	125	139	141
Birmingham, Alabama (A)	1	1	13	1	1	13
Bismarck, North Dakota (A)	251	205	227	251	205	251
Block Island, Rhode Island (A)	94	60	88	94	60	88
Boise, Idaho (A)	145	78	135	145	78	135
Boston, Massachusetts (A)	107	71	62	107	71	62
Bozeman, Montana (C)	...	181	336	...	181	336
Buffalo, New York (A)	132	137	122	132	137	122
Burlington, Iowa (A)	47	68	83	47	68	83
Burlington, Vermont (A)	224	199	172	224	199	172
Butte, Montana (C)	(a)	210	344**	(a)	210	344**
Cairo, Illinois (C)	4	3	28	4	3	28
Charleston, South Carolina (C)	0	0	0	0	0	0
Charlotte, North Carolina (A)	0	13	7	0	13	7
Chattanooga, Tennessee (A)	3	11	24	3	11	24
Cheyenne, Wyoming (A)	132	139	241	132	139	241
Chicago, Illinois (C)	29	58	76**	29	58	76**
Cincinnati, Ohio (C)	5	16	42	5	16	42
Cleveland, Ohio (A)	45	92	75	45	92	75
Columbia, Missouri (A)	16	25	62	16	25	62
Columbia, South Carolina (A)	0	1	0	0	1	0
Columbus, Ohio (C)	23	45	59	23	45	59
Concord, New Hampshire (A)	226	190	192	226	190	192
Concordia, Kansas (C)	18	15	55	18	15	55
Dallas, Texas (A)	0	0	0	0	0	0
Dayton, Ohio (A)	31	63	74	31	63	74
Deer Lodge, Montana (C)	(a)	286	399**	...	286	399**
Denver, Colorado (A)	71	47	120	71	47	120
Des Moines, Iowa (A)	48	66	99	48	66	99
Detroit, Michigan (A)	71	102	96	71	102	96
Devils Lake, North Dakota (C)	331	266	276	331	266	276
Dodge City, Kansas (A)	15	16	40	15	16	40
Dubuque, Iowa (A)	101	150	149	101	150	149
Duluth, Minnesota (C)	326	309	277	326	309	277
Elkins, West Virginia (A)	84	159	122	84	259	122
El Paso, Texas (A)	0	0	0	0	0	0
Ely, Nevada (A)	253	160	228	253	160	228
Escanaba, Michigan (C)	255	222	247	225	222	247
Evansville, Indiana (A)	16	23	59	16	23	59
Fargo, North Dakota (A)	246	214	215	246	214	215
Fort Smith, Arkansas (A)	1	4	9	1	4	9
Fort Wayne, Indiana (A)	44	109	107	44	109	107
Fort Worth, Texas (A)	0	0	0	0	0	0
Fresno, California (A)	0	0	0	0	0	0
Galveston, Texas (C)	0	0	0	0	0	0
Grand Junction, Colorado (A)	35	2	36	35	2	36
Grand Rapids, Michigan (A)	114	161	144	114	161	144
Green Bay, Wisconsin (A)	204	203	183	204	203	183
Greensboro, North Carolina (A)	4	24	29	4	24	29
Greenville, South Carolina (A)	0	13	10	0	13	10
Harrisburg, Pennsylvania (A)	40	66	69	40	66	69
Hartford, Connecticut (A)	130	99	101	130	99	101
Hatteras, North Carolina (C)	0	0	0	0	0	0
Havre, Montana (C)	239	268	270	239	268	270
Helena, Montana (A)	285	184	320	285	184	320
Houston, Texas (C)	0	0	0	0	0	0
Huron, South Dakota (A)	112	130	149	112	130	149
Indianapolis, Indiana (A)	30	56	79	30	56	79
Jackson, Mississippi (A)	0	0	0	0	0	0
Kansas City, Missouri (A)	7	13	44	7	13	44
Knoxville, Tennessee (A)	1	6	33	1	6	33
La Crosse, Wisconsin (A)	129	129	152	129	129	152
Lander, Wyoming (A)	138	120	244	138	120	244

(a) Data not available.

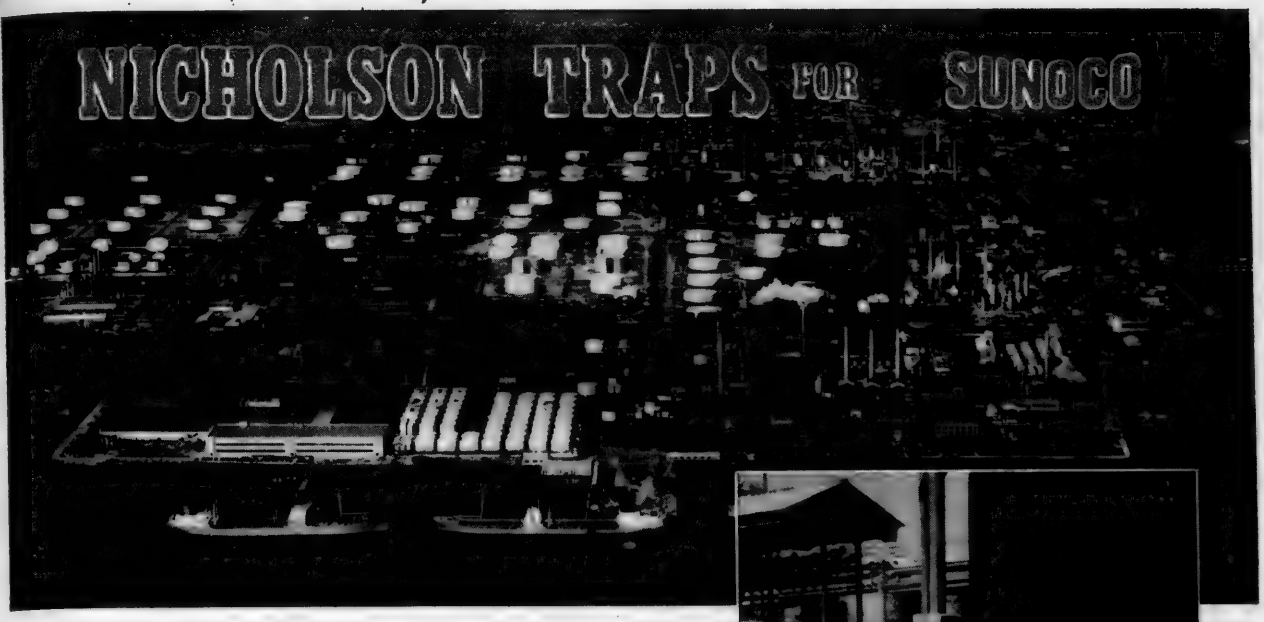
*Heating season, cumulative, from Sept. 1.

**Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company. Tacoma figures through the courtesy of the Tacoma News Tribune.

[Table concluded on page 142]

NICHOLSON TRAPS FOR SUNOCO



Air view of Sun Oil Company's refinery at Marcus Hook, Penna.

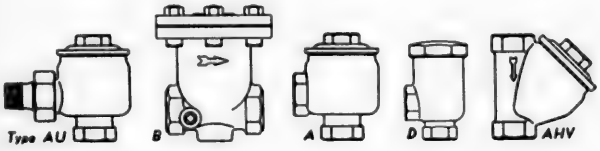
Standard for

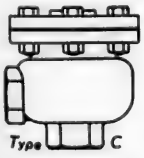
OUTDOOR USE

Due to

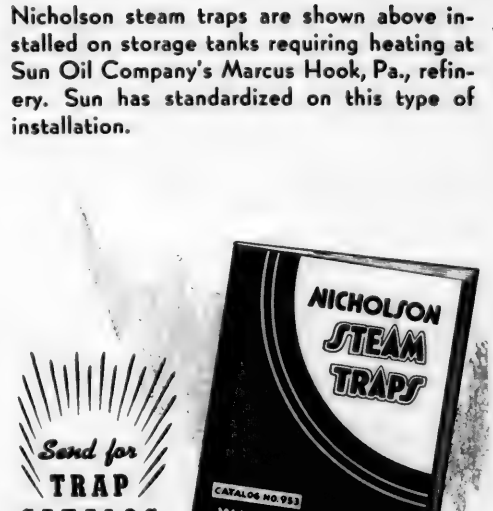
FREEZE-PROOF

Feature



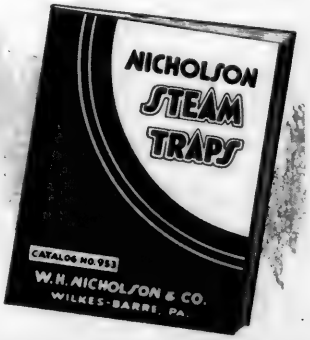


SIX TYPES FOR PROCESS, HEAT AND POWER -- Construction of bronze, semisteel or cast steel. In sizes of ¼" to 2" for pressures to 300 lbs. All six types of traps have stainless steel valves and seats. Bellows are furnished in bronze, monel or stainless steel.



Nicholson steam traps are shown above installed on storage tanks requiring heating at Sun Oil Company's Marcus Hook, Pa., refinery. Sun has standardized on this type of installation.

Send for **TRAP CATALOG**



W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

199 Oregon Street, Wilkes-Barre, Pa.
Sales & Engineering Offices in 58 Key Cities

Degree-Days for September, 1954 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 27th Year of Publication of Monthly Degree-Day Data

City	September			Season to Sept. 30, incl.*		
	1954	1953	Normal	1954-55	1953-54	Normal
Lansing, Michigan (A)	(a)	169	140	(a)	169	140
Lewiston, Maine (O)	252	229	165**	252	229	165**
Lincoln, Nebraska (C)	32	39	79	32	39	79
Little Rock, Arkansas (A)	0	0	0	0	0	10
Livingston, Montana (C)	(a)	162	227**	(a)	162	227**
Los Angeles, California (C)	0	2	17	0	2	17
Louisville, Kentucky (A)	13	21	51	13	21	51
Lynchburg, Virginia (A)	9	40	49	9	40	49
Macon, Georgia (A)	0	0	0	0	0	0
Madison, Wisconsin (C)	109	136	137	109	136	137
Marquette, Michigan (C)	285	253	236	285	253	236
Memphis, Tennessee (A)	0	1	17	0	1	17
Meridian, Mississippi (A)	0	0	0	0	0	0
Milwaukee, Wisconsin (A)	92	123	134	92	123	134
Minneapolis, Minnesota (A)	158	139	157	158	139	157
Moline, Illinois (A)	58	95	96	58	95	96
Montgomery, Alabama (A)	0	0	0	0	0	0
Nantucket, Massachusetts (A)	133	93	111	133	93	111
Nashville, Tennessee (A)	4	6	22	4	6	22
New Haven, Connecticut (A)	116	80	93	116	80	93
New Orleans, Louisiana (C)	0	0	0	0	0	0
New York, New York (C)	44	39	39	44	39	39
Newark, New Jersey (A)	53	45	47	53	45	47
Norfolk, Virginia (A)	4	7	9	4	7	9
North Platte, Nebraska (A)	77	101	120	77	101	120
Oak Ridge, Tennessee (C)	6	16	(a)	6	16	(a)
Oakland, California (A)	62	32	76	62	32	76
Oklahoma City, Oklahoma (A)	0	0	12	0	0	12
Omaha, Nebraska (A)	36	40	88	36	40	88
Parkersburg, West Virginia (C)	(a)	50	56	(a)	50	56
Peoria, Illinois (A)	36	62	86	36	62	86
Philadelphia, Pennsylvania (C)	18	29	33	18	29	33
Phoenix, Arizona (A)	0	0	0	0	0	0
Pittsburgh, Pennsylvania (C)	26	57	56	26	57	56
Pocatello, Idaho (A)	181	87	183	181	87	183
Portland, Maine (A)	255	226	199	255	226	199
Portland, Oregon (C)	97	60	105	97	60	105
Providence, Rhode Island (A)	118	118	63	118	118	63
Pueblo, Colorado (A)	28	29	74	28	29	74
Raleigh, North Carolina (A)	1	7	10	1	7	10
Rapid City, South Dakota (A)	110	109	193	110	109	193
Reading, Pennsylvania (C)	36	53	57	36	53	37
Red Bluff, California (A)	6	0	0	6	0	0
Reno, Nevada (A)	217	67	165	217	67	165
Richmond, Virginia (A)	5	28	33	5	28	33
Rochester, New York (A)	157	152	133	157	152	133
Roswell, New Mexico (A)	0	0	8	0	0	8
Sacramento, California (C)	4	0	17	4	0	17
St. Joseph, Missouri (A)	21	27	49	21	27	49
St. Louis, Missouri (C)	(a)	10	38	(a)	10	38
Salt Lake City, Utah (A)	93	28	88	93	28	88
San Antonio, Texas (A)	0	0	0	0	0	0
San Diego, California (A)	0	3	24	0	3	24
Sandusky, Ohio (C)	28	71	66	28	71	66
San Francisco, California (C)	118	88	110	118	88	110
Sault Ste. Marie, Michigan (A)	322	333	298	322	333	298
Savannah, Georgia, (A)	0	0	0	0	0	0
Scranton, Pennsylvania (C)	101	117	115	101	117	115
Seattle, Washington (C)	129	104	134	129	104	134
Sheridan, Wyoming (A)	168	139	239	168	139	239
Shreveport, Louisiana (A)	0	0	0	0	0	0
Sioux City, Iowa (A)	65	91	128	65	91	128
Spokane, Washington (A)	226	149	205	226	149	205
Springfield, Illinois (A)	33	31	56	33	31	56
Springfield, Missouri (A)	11	13	61	11	13	61
Syracuse, New York (A)	138	134	117	138	134	117
Tacoma, Washington (C)	125	111	177	125	111	177
Terre Haute, Indiana (A)	(a)	54	77	(a)	54	77
Toledo, Ohio (A)	58	109	102	58	109	102
Topeka, Kansas (C)	13	14	42	13	14	42
Trenton, New Jersey (C)	45	54	55	45	54	55
Utica, New York (O)	181	165	182**	181	165	182**
Valentine, Nebraska (C)	114	107	145	114	107	145
Walla Walla, Washington (C)	77	36	93	77	36	93
Washington, D. C. (C)	8	28	32	8	28	32
Wichita, Kansas (A)	3	9	32	3	9	32
Williston, North Dakota (C)	304	220	261	304	220	261
Winnemucca, Nevada (A)	260	100	180	260	100	180
Yakima, Washington (A)	166	142	150	166	142	150

For footnotes, see page 140.

IRON FIREMAN SelecTemp TRADE MARK CENTRAL HEATING

Continuous Modulated Heat with Individual Room Control, for Gas, Oil, or Coal

FOR OFFICE BUILDINGS

The temperature of every office can be regulated to suit individual needs. Temperature stays at thermostat setting regardless of varied heat loss from glass areas, or from cold and warm sides of the building.

FOR APARTMENTS, HOTELS AND MOTELS

Occupants of each room can have the temperature they select without affecting the heat delivered to other rooms. The steam heat is continuous. Room units circulate warmed air, modulated automatically to balance heat loss from each room and maintain the individual temperature selected. No gas or combustion in rooms—no venting required.

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The varying needs of patients rooms, of service and operating rooms, of offices and public lounges, are met with extreme precision and with almost immediate response to any desired change of temperature. Filtered outside air for ventilation can be introduced when desired. Positive circulation of air within each room but no circulation *between* rooms.

FOR EVERY SIZE AND TYPE OF HOME

Any temperature desired is available in any room, at any time. For example: bathrooms at 75°, living room at 72°, work and play rooms at 65°, and grandmother's room or baby's bath at 78°. Air is warmed by steam, quietly circulated by steam driven fans and cleaned by efficient air filters. Room units have no electrical connections.

A COMPLETELY NEW CONCEPT IN HEATING

Iron Fireman SelecTemp is the only heating system that combines individual room control with continuous, modulated heat, yet initial and maintenance costs are *substantially less* than other zone control systems, with complex electrical equipment. No other system can accomplish these results in such a simple and practical way, or be so easily installed in either old or new construction. Added to this economy is the exceptionally low operating cost. Unused rooms can be kept at low temperature and then heated to a higher temperature, when desired, within a few minutes.

SelecTemp heating gives many important and unique advantages not only to occupants but to owners and builders as well. For full information, mail the coupon.

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NEWS OF THE MONTH

MINIMUM POWER FACTORS

established for air conditioners in report issued by joint committee on cooling equipment.

Inter-industry accord on recommended minimum power factors for room air-conidtioners has been reached with the release of a report by the Joint Committee on Air-Conditioning and Refrigerating Equipment which is composed of representatives from the Air-Conditioning and Refrigeration Institute, Edison Electric Institute, and National Electrical Manufacturers Association. This report results from months of careful study by the Joint Committee and other interested groups.

● **MINIMUM VALUES.**—The report establishes recommended minimum power factor values based on unit size, calling for a minimum of 75% for ⅓ horsepower room air-conditioners, 80% for ½ horsepower units, and 85% for ¾ horsepower and larger. Power factors are to be measured at Underwriters' Laboratories maximum normal load test conditions; —104 F db and 80 F wb on both sides of the unit and 120, 208, or 240 volts (depending on the unit voltage rating) at the unit service connection. These recommended minimums are to be effective starting with 1956 models.

RESEARCH CENTER

will reproduce all climates for Army Quartermaster Research and Development Command.

Facilities for reproducing all the climatic situations in the world have been built into a new, $11 million Quartermaster scientific center, located on Lake Cochituate, about 15 miles west of Boston. The center represents a consolidation of Quartermaster Corps research laboratories heretofore scattered throughout the country and houses the headquarters of the Quartermaster Corps Research and Development Command.

● **FUNCTION.**—The Quartermaster Corps supplies the Army with fundamental needs such as food, clothing, personal gear, petroleum handling equipment, and temporary shelter. The new center is unique in that it is the first example of an institution operated to study all phases of human reaction to environment under virtually all probable military conditions.

● **WATER SUPPLY.**—The location of the center on Lake Cochituate affords advantages in the vital problem of water supply. The lake, 5 miles long and ½ mile across at its widest part, has a volume of something over 2 billion gallons. One of the deciding factors in the choice of location was the fact that the Center requires the use of eight million gallons of water daily. This is pumped from the lake, used as required, then returned to the lake as clean as it came out, and with an incidental temperature rise of less than 2½ degrees. Drinking water is from the city mains. The Boiler-Pump House has three 300 hp water tube boilers, with space for one more. Circulation condensation, and fire fighting pumps are located in the basement. The water tower, for fire fighting only, has a capacity of 75,000 gallons. The fuel storage tank capacity is 48,000 gallons.

● **BUILDINGS.**—The site consists of 100 acres of level land, 20 of which are devoted to ten reinforced concrete buildings which house the varied research and development activities.

The three-story Administration Building contains the offices, a complete technical library, a cafeteria, and an auditorium seating 500. This building requires a staff of approximately 250 civilians and from 20 to 25 military personnel.

Most remarkable of the major structures at the center is the Climatic Research Laboratory, which houses the specialized equipment required for climatic stress tests.

The Research Building, largest of the group, accommodates approximately 300 civilians representing elements from four different divisions; Environmental Protection; Textile, Clothing and Footwear; the Research Lab; and Dispensing and Handling Equipment. The building has three stories (as has the Administration and Development buildings) and has an up-to-date weather station on the roof, fitted with standard meteorological instruments.

The Development Building will be manned by approximately 300 civilians representing scientists and technologists of the Mechanical Engineering, Textile, Clothing and Footwear, and Chemical and Plastics Divisions.

Among the modern devices in the one-story Engineering Building is a forty-foot rain tower capable of a downpour equivalent to 3 inches of rain an hour. An element of the Chemical and Plastics Division, the Films, Filaments, and Coated Fabrics Branch, occupies considerable space in the Engineering Building, and also has space in the Development Building. Here research laboratories furnish various facilities for evaluation, under controlled conditions, of detergents, fungicides, rodenticides, germicides, pretreatments and protective finishes, paper and paper products, adhesives, and plastic laminations such as those found in the Quartermaster body armor.

● **CLIMATIC RESEARCH.**—The Climatic Research Building houses both arctic and tropic chambers. These rooms can accommodate up to 25 test subjects at a time and can produce temperatures ranging from —70 F to +70 F in one; and from zero to a scorching 165 F in the other. At the same time, if desired, the chambers can be subjected to controlled wind velocities up to 40 miles per hour. In the tropic chamber, solar radiation, ground radiation, humidity, rain, and desert aridity are also available in the volume and force a given study may require. The arctic chamber is equipped with a refrigeration compressor of the centrifugal type. The tropic chamber is similarly equipped but with certain added facilities for the control of humidity and temperature. The fans of the wind tunnel measure 13 feet in diameter and require motors of 400 hp each to operate them. The Climatic Building will be manned by eight scientists and a minimum operating crew of eight engineers and technicians. Enlisted men will serve as test subjects.

(*Continued on page* 146)

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You'll find it pays off in hard cash to rely on Allis-Chalmers for your air conditioning pump needs. That's because your A-C representative or distributor is an experienced, highly qualified specialist who will give you full cooperation at every step of the way. He'll help you pre-engineer the setup. In many cases he'll make valuable suggestions which result in a simpler, more effective layout.

Get immediate delivery from stock

A-C air conditioning pumps in a complete range of types and sizes are carried in stock by Regional Warehouses and Authorized Distributors throughout the country. Your representative will show you how to expedite pump selection and ordering . . . make sure you get the unit that gives you maximum performance at minimum cost. Find out for yourself why it's highly profitable in terms of time, money, and customer satisfaction to install Allis-Chalmers air conditioning pumps. Contact your representative before you start your next job.

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ALLIS-CHALMERS

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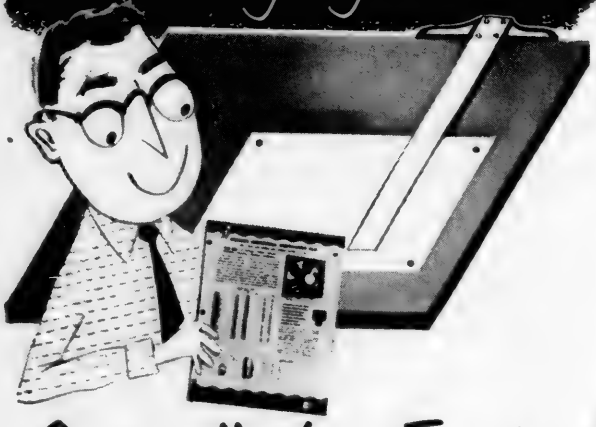

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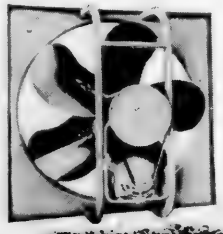
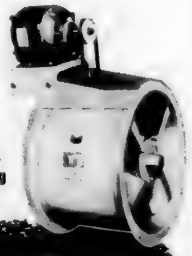
Each new job presents different cooling and ventilating problems that we can successfully solve for you . . . Write us for complete data on the hundreds of possibilities offered in the wide range of styles, sizes and capacities of Chelsea Fans—ask for Data Sheets #600 or, for technical assistance, call our engineers.

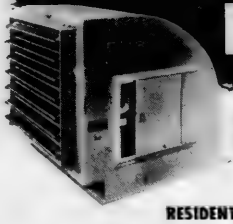


FOR GENERAL VENTILATION
Type IND

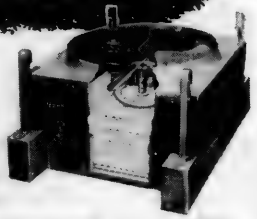


DUCT BOOSTER
Non-Overloading
Type PLDX

CHELSEA FANS



ROOF PENT-HOUSE UNIT
Type PH



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PFMA

Every Chelsea fan has a PFMA Certified Rating. Sturdy, all-steel construction for long and dependable service.

CHELSEA

CHELSEA FAN & BLOWER CO., INC.
PLAINFIELD • NEW JERSEY
MANUFACTURERS OF INDUSTRIAL & HOME VENTILATING EQUIPMENT

RESEARCH CENTER

(*Continued from page* 144)

● **PHYSIOLOGY.**—Stress Physiology Branch will study how the body's responses to the many stresses of military living affect clothing requirements. Search will be made for physiological and biochemical indices of the adequacy of protection afforded by different uniforms.

Biophysics Branch will apply physical and biophysical principles to environmental problems. It will analyze the stress on man of his equipment and such environmental factors as temperature, humidity, wind, rain, sunshine and terrain, indicate how various factors and principles can be applied to the design of clothing and equipment.

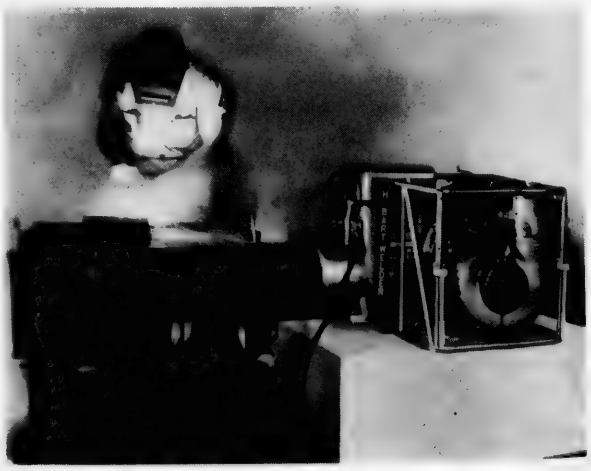
Chambers and Field Research Branch will conduct physiological chamber and field studies to determine the soldier's reaction to environmental-equipment stresses.

● **ENVIRONMENTAL RESEARCH.**—Environmental Research Branch, consisting of three sections, is charged with the responsibility of applying the techniques of geography, climatology, and cartography to the various problems involved in the protection of the soldier from the stresses imposed by his environment. This branch will define, analyze, and map the topographic, climatic, and cultural features of the mountain, desert, wet-tropical, and cold areas of the world for the purpose of determining the nature, distribution, and intensity of the various environmental elements and combinations of elements which affect the performance of the soldier and his equipment.

● **MECHANICAL ENGINEERING.**—Objectives of the Mechanical Engineering Branch are simplification, standardization, decrease in weight and bulk, increase in versatility, ease of maintenance, interchangeability of components, and increase in reliability of equipment.

GAS TURBINE

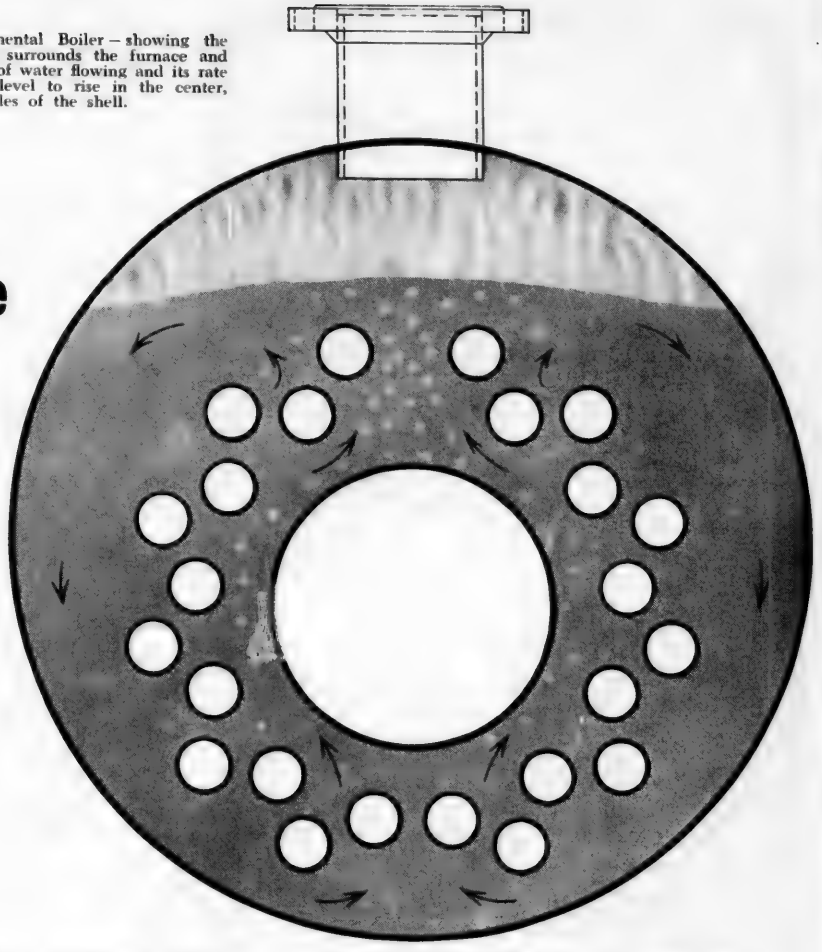
used as a prime mover on experimental arc welder built for use in research on future power plants.



The first arc welder to use a gas turbine as a prime mover has been developed at Hobart Brothers scientific

(*Continued on page* 148)

Cross-section of a Continental Boiler – showing the free flow of water which surrounds the furnace and return tubes. The volume of water flowing and its rate of flow cause the water level to rise in the center, then fall away to both sides of the shell.



What makes the Continental Boiler last longer... makes steam cost less

If you were to design a packaged boiler, water circulation would be a basic consideration because . . .

. . . poor circulation can cause overheating . . . can cause unequal stress in metal heating surfaces . . . can promote pitting and scaling on metal surfaces exposed to water . . . and can result in higher stack temperatures, decreased boiler efficiency.

But the many owners of Continental Boilers have had none of these troubles. Here are two special reasons why:

1. Two-pass design provides even flow of combustion gases to all heating surfaces.

Heat is thus distributed evenly to the rear tube-sheet and to all of the return tubes. Water is heated uniformly, and natural, balanced circulation results.

If high temperature combustion gases were to enter only one section of the return tube bank, the tubes in that section would be at a higher temperature, would be doing more work than the balance of the tube-sheet and return tubes. The result: water surrounding those cooler heating surfaces would have sluggish circulation.

2. Heating surfaces in the Continental Boiler are arranged so that there is a centrally located furnace and equal spacing of return tubes.

Of the total heat transferred to the water within a Continental Boiler, about 60% is transferred by the furnace. Thus it is essential that flow of water around the furnace be unrestricted. Note the area around and above the furnace and the open channel along both sides of the boiler shell. This design assures unrestricted flow of water around the furnace . . . facilitates rapid flow of water to the bottom of the boiler for reheating.

Uniform . . . free . . . rapid water circulation is an important reason why a Continental Boiler costs little to keep, has long service life, and makes steam cost less. For detailed information write for Bulletins BE-3, BE-4.

BOILER ENGINEERING & SUPPLY COMPANY, INC.

Phoenixville, Pa.

CONTINENTAL . . .
the boiler with the spinning gas technique

PROBLEM:
"We need a new heating system, but can't afford an expensive one."

SOLUTION:
"We saved $6000 by installing Delta OIL-FIRED UNIT HEATERS in our plant!"

"We had neither the space nor the funds to install a complex boiler system . . . and the cost of gas in this area was too high for our budget. So we struggled along with inadequate heating . . . until Delta direct-fired Oil Unit Heaters solved our problem. They're doing a big job at an unbelievably low cost!"

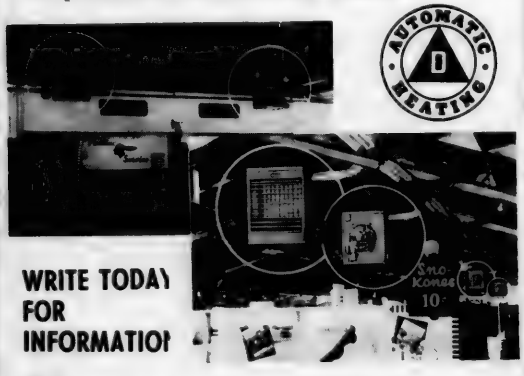
Delta
DIRECT-FIRED OIL UNIT HEATERS
fit everybody's budget, everybody's needs.

SIMPLEST TO INSTALL: Big savings on installation costs. They need no large chimney, boilers, pipes, fittings. Factory wired and assembled . . . just hang them up.

LOWEST COST OPERATION: Delta's powerful pressure oil burner does a most effective and efficient heating job on low cost #2 fuel oil. Maintenance is simple and seldom. Costs 50% less to operate than old-style systems.

GREATEST COMFORT: Within seconds the Delta Unit Heater bathes the entire working zone with comfortable, even heat . . . with no cold spots, no overheating. Ten sizes from 112,000 to 220,000 BTU/hr. to meet all situations.

On your next installation, let DELTA OIL UNIT HEATERS solve all your price and performance problems.



WRITE TODAY FOR INFORMATION

Delta HEATING CORPORATION
10 COLE STREET • TRENTON 8, N. J.

GAS TURBINE

(*Continued from page* 146)

research division at Troy, N. Y. The 250 ampere capacity d.c. welding generator has been successfully operated and tested under actual working conditions.

● **EXPERIMENT.**—The project is not a commercial venture, but rather a development designed to provide up-to-date information in the fast changing field of engineering and equipment. The company, in building this special unit, is primarily interested in knowing more about the gas turbine and the possibilities it might hold in building more compact, lighter weight equipment.

● **APPLICATION.**—Greatly reduced weight and size are decided advantages of using the gas turbine that could well be the power of tomorrow. The company feels that the turbine type of power may be the answer to lighter airborne equipment that could be easily transported in smaller aircraft than the present cargo planes.

INDUSTRIAL HYGIENE

to be reviewed at Annual Meeting of Industrial Hygiene Foundation. Control of air pollution featured.

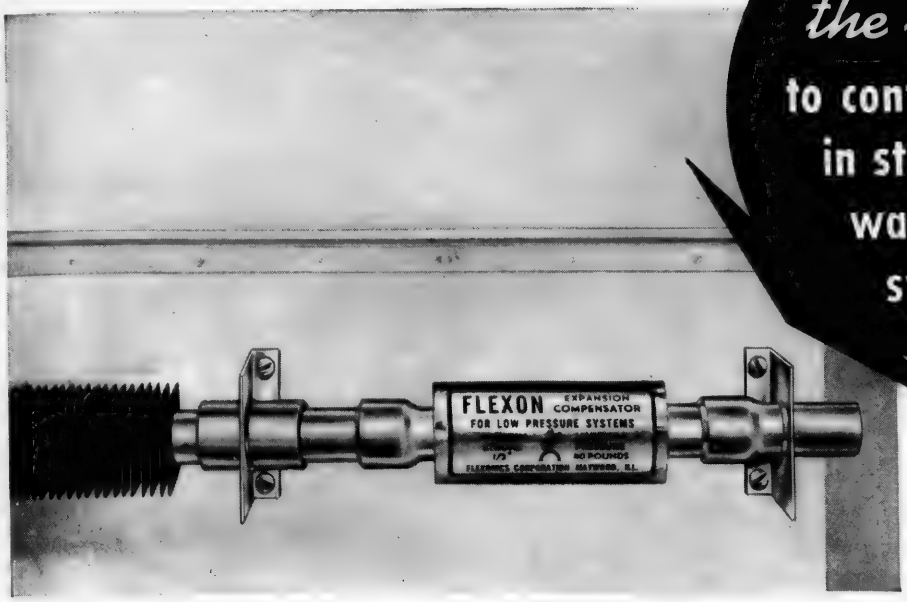
Potential industrial health hazards, as well as the major health problems now facing manufacturers, will be taken up at the 19th Annual Meeting of Industrial Hygiene Foundation to be held at Mellon Institute, Pittsburgh, Pa., on November 17 and 18.

● **INDUSTRY LEADERS.**—Some 800 leaders in the industries and professions from all parts of the United States will participate in medical, engineering, chemical-toxicological, legal and joint medical-legal conferences. They will represent the 360 member companies of the Foundation.

● **SPEAKERS.**—On the program are an outstanding group of speakers on topics relating to industrial health which are at present of great concern to management. Clifford F. Hood, president, United States Steel Corp., will speak on management aspects of industrial health. Dr. Norbert J. Roberts, medical director of the Pennsylvania Railroad, will talk on horizons of industrial medical services. Dr. Roberts has facts and figures and, even more important, suggested modus operandi for setting up a system-wide maintenance health program designed to benefit all employees and at the same time set a new high for production efficiency. With increasing responsibility for plant protection and post-attack defense measures falling on industry, the problem civil defense for the industrial plant is a major one. Val Peterson, administrator of Federal Civil Defense, and former Governor of the State of Nebraksa, will present a practical approach to the problem. Dr. Donald A. Covalt, associate director of the Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, will bring with him to the rostrum a wealth of experience in the field of rehabilitation, his subject for discussion. The significance of industrial wastes will be discussed by Dr. Richard D. Hoak, Mellon Institute, who is well known for his accomplishments in this field.

(*Continued on page* 150)

Here's the right way to control expansion in steam and hot water heating systems...



THE *New* FLEXON EXPANSION COMPENSATOR...

DESIGN DETAILS

The Flexon Expansion Compensator consists of a two ply phosphor bronze bellows with copper tube end connections (sizes ¾" to 1¼") enclosed in a floating protective shroud of brass. All joints are electronically sealed with silver solder for long leak-proof life. The 2" size is especially guided and has standard threaded fittings. A single compensator will handle total piping motion up to ⅝" (½" in compression, ⅛" in extension). Suitable for temperatures from —60° F. to 250° F. and for pressures up to 40 psig.

Control of thermal expansion in low pressure steam and hot water heating systems need not be a headache any longer. The new Flexon Expansion Compensator provides a practical, economical answer to the problem. Designed especially for finned type convectors, baseboard, radiator or heating supply or return lines, the Flexon Expansion Compensator is ideally suited for use in homes, office buildings, schools or any buildings where expansion in heating piping is a problem.

The Flexon Expansion Compensator is practical because it puts an end to leakage that often results from uncontrolled expansion and eliminates objectionable pipe creeping noises. It is economical because it is designed to outlast the building and requires no maintenance whatsoever. Just install it and forget it.

Flexon Expansion Compensators are made in ¾", 1", 1¼" and 2" sizes. Contact your local distributor for further information, or use the coupon below to get your copy of a descriptive bulletin.

Flexonics *Corporation*

Flexon identifies products of Flexonics Corporation that have served industry for over 52 years.

EXPANSION JOINT DIVISION
1326 S. Third Avenue
Maywood, Illinois

Flexonics Corporation
1326 S. Third Ave.
Maywood, Ill.

Please send me the bulletin which describes and gives full specifications for the Flexon Expansion Compensator.

Name .....

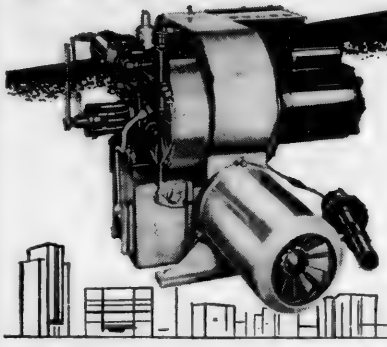
Company .....

Address .....

City..... *Zone*.... *State*.....

My Wholesaler is:.....

Hev-E-Oil Burner keeps heat cheap!



FOR COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL INSTALLATIONS

Use heavy fuel oils *costing 30% less per gallon*

Cheap heat is smart economy! That's why thousands of owners are converting to Hev-E-Oil Burners and using *commercial* No. 4 or 5 heavy oils, costing 3 to 6¢ *less* per gallon than domestic light oils. Owners not only pocket the difference in cash, but get 7% more heat per gallon as well.

Hev-E-Oil Burners are specifically designed for heating buildings requiring more than 6,000 gallons of oil or 45 tons of coal per year.

Conversion is simple. The Hev-E-Oil fits all types of standard heating boilers and change-over takes only a few hours' time. Reports on file show fuel savings pay for conversion in a season or two.

QUICK FACTS ON HEV-E-OIL BURNER

- Automatic, oil-electric ignition
- Flame size set exactly to furnace capacity
- Low-pressure, air-atomizing, with large, non-clogging nozzle
- Six sizes: 1 to 60 gph
- Built-in low fire start
- As simple to install as a domestic burner
- Easy servicing and cleaning
- Air and oil metered to give high efficiency

If you own, specify, install or service burners, get all the facts about Hev-E-Oil Burner — a *quality* product of America's leading manufacturer of self-contained boilers and oil-fired equipment. Write for illustrated Bulletin AD-102 NOW. CLEAVER-BROOKS COMPANY, Dept. M, 382 E. Keefe Ave., Milwaukee, Wis.

Sales and Service In Principal Cities

Cleaver Brooks

HEV-E-OIL BURNERS ARE DESIGNED TO SAVE YOU MONEY

INDUSTRIAL HYGIENE

(*Continued from page* 148)

● **ENGINEERING.**—The Engineering Conference will bring to the attention of plant engineers new developments and ideas on engineering measures that may have effects on the working environment. Papers will be presented on physicochemical dust suppression in final products; the role of oxidation catalysts in air pollution control; outdoor ventilation for particular industries by open plant construction; recent developments in noise control; and specific instances of measures taken to control temperature, ventilation, and noise. A report on stack dust measurement research will also be given.

Dr. C. Richard Walmer, managing director of the Foundation, is in charge of arrangements. Andrew Fletcher, president of St. Joseph Lead Company, and board chairman of the Foundation, will present the annual report after a welcoming address by Dr. E. R. Weidlein, president of Mellon Institute.

RISING GAS SALES

indicated for 1954-57 period by AGA report on gas requirements and supplies. Home sales predominate.

Sales of gas by utilities and pipelines in 1957 will aggregate 74.3 billion therms, an increase of 31.5% over actual sales of 56.5 billion therms in 1953, according to a report on gas requirements and supplies just published by the American Gas Association. Supplies of gas from existing and planned facilities to meet these increased requirements will total 81.6 billion therms, an advance of 20.7% over total supply of 67.6 billion therms available last year.

● **PIPING.**—To meet increased demands for service, the gas industry will require 4.6 million tons of steel pipe during the 1954-57 period inclusive. Of this amount 2.9 million tons will be in the form of 16-inch diameter and over, primarily used for gas transmission lines. An additional 134,000 tons of steel in other forms and 446,000 tons of cast iron will be required by the industry in the 1954-57 period.

● **RESIDENTIAL HEATING.**—Anticipated residential space heating requirements in 1957 will exceed those experienced in 1953 by 53% and will represent nearly one-fourth of total annual demand of all customers of the industry in 1957. Residential space heating customers will aggregate 16.9 million in 1957, equivalent to a gain of 32% over the total of households heated with gas at the end of 1953. Peak day requirements for residential space heating are expected to increase 44% during the four years under review, to total more than 214 million therms during the 1957-58 heating season.

Residential base load consumption on an annual basis is expected to increase 20% between 1953 and 1957, while commercial and firm industrial consumption will advance 29% and 27% respectively. The growth of the latter two categories may be influenced to some extent by a more substantial growth in heating requirements.

● **INDUSTRIAL HEATING.**—On an annual basis firm industrial sales will account for 45% of total industry sales

(*Continued on page* 152)

air conditioning ducts

. . . installed in a matter of minutes with

DRIVE-IT SYSTEM

SPLIT SECOND FASTENINGS TO CONCRETE OR STEEL

Air Conditioning on the new Hotel Algiers in Miami, Fla., was speeded by use of Drive-it Fastening Tools.

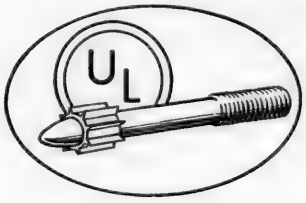
Fastening overhead installation even in cramped conduit tunnels easy for new Drive-it 320.

DRIVE-IT 320

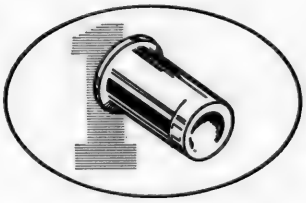
WITH

BREAK-OPEN ACTION

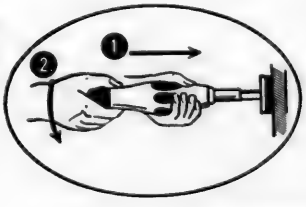
Snap open action results in the fastest operating tool on the market. Easiest method to load and eject cartridges under any condition.



Drive pins are Underwriters' Laboratories approved.



Controlled Power. First and only tool which requires but one standard power load regardless of penetration desired. No need to buy and stock various strength power loads.



Three-way Safety. Cannot be discharged accidentally, due to the push and turn firing sequence. This, plus the large, swivel safety pad, makes DRIVE-IT triple safe.

More fastenings per hour with this speedy way of loading and ejecting cartridges.

SEND THIS COUPON FOR FULL DETAILS

POWDER POWER TOOL CORP.
Dept. 2, 7526 S.W. Macadam Ave., Portland 1, Ore.
Canada: Ammo Power Tool Co., Ltd.
735 Broadway, Vancouver, B. C.

☐ Please send FREE catalogue and literature.
☐ I want a FREE demonstration of *DRIVE-IT*.

Name_____
Street_____
City_____ State_____

DRIVE-IT
the original **POWDER-ACTUATED TOOL**

50 MILLION MOTORS IN 25 YEARS

Such acceptance proves Redmond motors! Because Redmond MicroMotors are small but powerful, compact and simple in design, they are preferred by leading manufacturers.

Features such as Tri-Flux design, self-aligning porous bronze bearings and oil and moisture resistant impregnated windings insure long life and trouble-free service.

For highest performance specify Redmond Micro-Motors, 1/500 to 1/6 horsepower; self-powered blowers delivering 50 to 280 C.F.M.

Call a Redmond engineer to discuss your needs!

Redmond
COMPANY, INC.
OWOSSO, MICHIGAN

THE BIG NAME IN SMALL MOTORS

RISING GAS SALES

(*Continued from page* 150)

in 1957 but will contribute only 24% of the peak day requirements during the 1957-58 heating season. Residential heating requirements will account for only 29% of total annual requirements during the last year of the forecast, but will represent 55% of the peak day needs. Sales of gas to interruptible customers are expected to increase slightly during 1955 and then level off between 16 and 16½ billion therms annually.

● **UNDERGROUND STORAGE.**—The absence of growth in interruptible sales is explained by the ever-increasing utilization of underground storage facilities for meeting peak day demands imposed by househeating requirements. Increasing quantities of surplus summer gas will be injected into underground storage for subsequent withdrawal, instead of being sold to interruptible users.

It is estimated that $114 million will be expended during the next four years on underground storage projects. Anticipated withdrawals during 1957 will aggregate 4.9 billion therms while on the 1957-58 peak day the expected underground storage withdrawals of 102 million therms will represent one-fourth of the total available supply of gas from all sources for the entire industry.

● **GEOGRAPHICAL TRENDS.**—The greatest relative post-war increases in demand and in customer acceptance of gas for gas househeating have occurred in northern areas. This reflects the tremendous pipeline expansion program making more gas available to the metropolitan centers of the north. Also reflected are the high heating saturation which has historically existed in the southern part of the country, and greater consumption requirements per customer in northern localities.

● **SOURCE.**—Data shown in the A.G.A. report provide comprehensive forecasts of national and regional statistics on an annual basis through 1957 and on the peak day through the 1957-58 heating season. Data shown relate to the entire industry and are based on replies to questionnaires from 159 gas companies, representing 87% of industry sales. The report is a continuation of the survey originally undertaken by the Gas Planning Division of the Petroleum Administration for Defense.

EXPOSITION EXHIBITS

being readied for heating and ventilating event in Philadelphia. Some completed as date approaches.

Many exhibits have already been completed for the 11th International Heating & Ventilating Exposition in Philadelphia, with the show opening less than three months away. It will open January 24 in the great Commercial Museum and Convention Hall. The show is sponsored by ASHVE, whose 61st annual meeting will be held during the same week.

● **SCOPE.**—The exposition covers the arts of heating, ventilating and air conditioning, which are distinct but joined together in applied design, and further united in embracing both industrial and hygienic objectives. The exposition is expected to reveal many innovations and improve-

(*Continued on page* 158)

HEATING AND VENTILATING'S *Ad-Digest* SERVICE

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

NOTE: While every attempt is made to list all advertisements, those which are received after the published closing date may not appear. The Index of Advertisers lists all the advertisements in this issue.

PUMPS. Page 43. These pumps, designed by men who really know pumps, feature quiet operation, low inlet connection and are easily accessible. They are available in single units or duplex. These pumps are adaptable to every installation. Bulletin available. ----------Item 201

VENTS. Page 22. This company's line of vents includes three air vents and an air eliminator. These units, of float and thermostatic construction express an unrivaled accumulation of knowledge in dealing with air venting problems. Catalog available. ----------Item 202

INDUSTRIAL HEATERS. Page 157. Induced flame and gases of combustion make four complete passes on the left and right sides of the heat transfer surface over the air to be heated. This four pass gas system provides more heat tranfer surface. Information available. ----------Item 203

FILTERS. Pages 48, 49. Over the past 21 months, this company has applied self-cleaning filters totaling over 21 million cubic feet of air per minute. Such overwhelming product acceptance best tells the story of these filters high efficiency and dependable, trouble-free performance. Information available. ----------Item 204

AIR FILTERS. Page 18. Whether you need filters for packaged air conditioners or furnaces, for general filtration or for special applications requiring the highest efficiency and greatest dirt capacity, this company has a standard type to fit the job. Available in steel, aluminum, copper, stainless and monel. Information available. ----------Item 205

AUTOMATIC BOILERS. Page 61. The new 240-bed Druid City Hospital, Tuscaloosa, Alabama, designed its steam system with three 300 hp gas-fired packaged automatic boilers manufactured by this company. These boilers are preferred by modern hospitals all over the world. Information available. ----------Item 206

STEEL TANKS. Page 161. These baked on plastic lined tanks last longer and cost less. They can often replace more costly installation of steel alloys and non-ferrous metals. Information available.----Item 207

GATE VALVES. Page 75. Look over the list of 40 patterns in this company's complete line of bronze gate valves. You will find the valve you need in this new folder with details of the extra value design and construction that makes these valves the best. Folder available. ----------Item 208

BOILERS. Page 147. These boilers last longer, make steam cost less, because their two-pass design provides even flow of combustion gases to all heating surfaces. Heating surfaces in this boiler are arranged so that there is a centrally located furnace and equal spacing of return tubes. Bulletins available. ----------Item 209

PACKAGED AIR CONDITIONERS. Page 63. You can meet all the requirements of any job when you sell these packaged air conditioners. This line, with 6 water-cooled and 4 waterless models, is a complete line. The air cooled waterless models have been improved in thousands of installations, and only this company has 5 and 7½ hp air-cooled, waterless models. Information available.----------Item 210

THERMOSTATIC CONTROLS. Page 56. You can trust your future reputation to this company's controls. This company's design combines pioneering experience with engineering leadership. The use of specially chosen metals assures your customers years of positive, accurate temperature control with lowest maintenance cost. Information available.----------Item 211

ALUMINUM SHUTTER. Page 168. Because they are so light, the aluminum louvers of these shutters are exceptionally sensitive to air current, opening the instant the fan or blower starts. Circular available. ----------Item 212

AIR FILTERS. Page 23. Quick and widespread response to recent introduction of these new and different filters indicates they fill a long-standing need for a service-easy, clean filter. No oil or messy adhesives are required with these dry air filters. Bulletin available. ----------Item 213

FLUSH VALVES. Page 9. If the expanding reputation of these flush valves is based on any single outstanding feature, that deserving compdnent is the chromed leather diaphragm with monel bypass port. Leather is used because it is resilient yet non-elastic. Therefore the danger of squealing, hammering close off is eliminated in favor of the smooth slow closing action. Bulletin available. ----------Item 214

FILTERS. Page 45. This ad points out the importance of good filter installation with a good seal. It details the company's electronic filter panel and newly developed synthetic paint which protects the filter panel. Information available. ----Item 215

PIPING SYSTEMS. Page 53. These piping systems are designed and constructed of quality materials, having proven their stability and reliability for many years. This insulated prefabricated piping system is one of the many popular systems manufactured by this company that are guaranteed to assure permanency, maintenance free operation and high efficiencies. Information available. ----------Item 216

PACKAGED AIR CONDITIONERS. Page 14. This company's trained experts helped a Washington builder custom-fit air conditioning to the needs of each floor. They took into consideration all the detailed factors that account for heat gains and losses and the nature of the tenant's businesses before making recommendations that resulted in installation of the company's packaged air conditioners. Information available. ----------Item 217

WELDED FITTINGS. Page 29. This company's engineering service division and experienced engineers often save thousands of dollars in piping costs. You get this service and other important values only when you purchase this company's welded flittings and flanges. This is the most complete line available. Information available ----------Item 218

BASEBOARD HEATING. Page 2. Quality operative builders have found that this company's forced hot water baseboard heaters meet their requirements. It is economical to install. There is a minimum of piping, no air ducts, radiators or registers. Bulletin available. ----------Item 219

CENTRAL HEATING. Page 143. This is the only heating system that combines individual room control with continuous, modulated heat, yet initial and maintenance costs are substantially less than other zone control systems, with complex electrical equipment. Easily installed in old or new construction. Literature available. ----------Item 220

FANS. Page 1. This fan is a direct motor-driven fan in a divided housing. Its motor is an isolated chamber around which fumes are bypassed so the motor stays cool, clean, and accessible. It installs just like a flanged section of ductwork, and is scarcely larger in diameter than the ductwork. Information available.----Item 221

TEMPERATURE REGULATOR. Page 28. Here are presented tips on what to look for when you're installing a new or replacing an old temperature regulator. This regulator features packless construction, broad control range, easy maintenance, and is self-operating. Bulletin available. ----------Item 222

UNIT HEATERS. Page 165. These unit heaters quickly and economically give needed warmth wherever heat is required. High velocity discharge assures adequate supply of heated air. Units are available with manual or automatic controls. Catalog available. ----------Item 223

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE SEND US MORE INFORMATION

Circle below item numbers on which you wish further information.

201	202	203	204	205	206	207	208	209	210	211	212	213	214
215	216	217	218	219	220	221	222	223	224	225	226	227	228
229	230	231	232	233	234	235	236	237	238	239	240	241	242
243	244	245	246	247	248	249	250	251	252	253	254	255	256
257	258	259	260	261	262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279	280	281	282	283	284
285	286	287	288	289	290	291	292	293	294	295	296	297	298
299	300	301	302	303	304								

PLEASE PRINT Nov. AD-54

This service available only to U. S. and Canadian readers

Name..... **Title**.....

Firm .....

Nature of Firm's Business.....

Street .....

City..... **Zone**..... **State**.....

This card is void after Feb. 1, 1955

Ad-Digest SERVICE

MOTOR COMPONENTS. Pages 26, 27. Cut engineering and installation time with this company's control motor drive components. With this control motor drive combination, one reliable supplier guarantees the complete drive. There's no worry about coordination of three sources of supply, and no worry whether the components will work together. Literature available. ----------Item 224

REFRIGERATION ENGINEERING. Page 55. This company has been serving the air conditioning and refrigeration industries since 1919. During that long span of years, the company has built a fount of knowledge and technical experience that enables it to design, build and select products to fit any temperature control problem. They offer a full library of technical literature. ----------Item 225

FANS. Page 170. The performance of these fans is in the prop design. Get top efficiency against resistances to 4½ inches SP without special equipment with these 7-blade propellers that move more air at slower motor speeds with less horsepower. Bulletin available. ----------Item 226

STEEL PIPE. Page 62. Advertisement tells how steel pipe is first choice for radiant heating as it is for convection heating. Proved in more than 60 years of service in steam and hot water systems, this pipe is the most widely used pipe in the world, for heating, plumbing, snow melting, fire sprinkler systems, and transmission of power, steam and air. Literature available. ----------Item 227

ELECTRIC MOTOR. Page 11. This motor has helped to build more than one product reputation by its outstanding performance. This motor is available for many applications in the air conditioning, heating and refrigeration field. The company has specialists ready to help solve the most complex motor problem. Bulletins available. ----------Item 228

AIR CONDITIONING PRODUCTS. Inside back cover. This company offers a full line of valves, strainers, driers, and gages. You pay no premium for the extra advantages found in these products. Catalogs available. ----------Item 229

STEEL BOILER. Page 10. In schools across the nation, the swing is to this company's boiler. The reason is its exclusive jet-action circulation, with its efficient heat transfer and economical operation. These boilers permit nearly instant response when a change in temperature is desired. Literature available. ----------Item 230

PACKAGED AIR CONDITIONERS. Page 64. This company teams central and packaged air conditioners to cool a new Miami Beach hotel. The system cools 142 rooms and 186,000 cubic feet of dining and lobby space. The system includes both central and packaged air conditioners. Information available. ----------Item 231

BLOWER UNITS. Page 50. These units can be furnished with tempering or heating coils or a combination of both for use with hot water and steam, and the accessories for controlling, filtering, and directing air flow. Available in wall, ceiling, or floor units. Bulletin available. ----------Item 232

STEAM TRAPS. Page 141. These steam traps are standard for outdoor use due to freeze-proof feature. They are available in six types for process, heat, and power. All six have stainless steel valves and seats. Bellows are furnished in bronze, monel, or stainless steel. Catalog available. ----------Item 233

HEATING & COOLING EQUIPMENT. Pages 38-39. From radiator traps to fully engineered systems, you can depend on this company for everything you need in heating. Included in the company's line are radiator valves, condensate pumps, wall radiation, circulators, unit heaters, and vacuum heating pumps. Information available. ----------Item 234

PIPE. Page 33. It's special delivery all the way when you order pipe from this company. In no time at all, the order is loaded and speeding to your door, or wherever you want it, in any size and any amount. Information available. ----------Item 235

VENTILATING FANS. Page 166. This company's fans keep air on the move at Wisconsin Electric Power Co.'s 100 million dollar power plant. From power house to powder room, from aircraft to zoological buildings, this company's ventilator applications literally range from A to Z. Information available. ----------Item 236

CONTROL DEVICES. Page 172. For hot water heating systems or domestic hot water supply systems, this company's pioneering research and engineering skill have produced protective and controlling devices that make water heating systems safe, efficient, and automatic. Information available. ----------Item 237

WATER LEVEL CONTROL. Page 164. A water level control which features a magnetic sleeve, rising and falling within a non-magnetic tube which trips or releases an Alnico permanent magnet attached to a mercury switch. Catalog available. ----------Item 238

VENTING VALVES. Page 51. For either one-pipe or two-pipe steam, hot water, residential or industrial heating, this company has the correct vent valve for each specific requirement. For hard to balance radiators, this line includes adjustable port valves available for vacuum and non-vacuum systems. Information available. ----------Item 239

FRESH AIR HEATERS. Page 66. These fresh air supply heaters are the answer to exhausted air. They supply make-up air properly heated, they require no expensive duct work, and the coils cannot freeze, regardless of the weather, because full steam pressure is on at all times. Information available. ----------Item 240

UNIT HEATERS. Page 148. These direct-fired oil unit heaters fit everyone's budget and needs. They are simple to install, economical to operate and provide the greatest comfort. Information available. ----------Item 241

CENTRIFUGAL FANS. Page 42. This company offers a complete new series of centrifugal fans, both forward curve and non-overloading offering the latest in improved designs, sturdier construction and quieter operation. Bulletins available. ----------Item 242

STEAM TRAPS. Page 54. The snap-action feature of these steam traps eliminates wire drawing. The valve action of the trip is instantaneous. It is either wide open or tight shut. The valve steam travels independently of the bucket. Information available. ----------Item 243

FUEL CUT-OFF. Back cover. The hard brass tubing of this low-water fuel cut-off is easily trimmed to gage glass spacing, but is strong and rigid to hold the cut-off in accurate alignment. A special precision fitting goes home easily and assures proper location and equalization. This control costs less installed and that's what counts. Catalog available.---Item 244

FLEXIBLE HOSE. Page 159. Solve your problems in air conditioning, fume control and ventilation, dust and chip collection and materials handling with this company's flexible hose. This is a high quality re-inforced spiral wire hose. Bulletins available. ----------Item 245

AIR DISTRIBUTION. Page 129. When this company entered the air distribution field nearly 20 years ago, laboratory facilities were established to simulate every possible condition of air distribution. From this laboratory has come reliable selection data and many of the industry's pioneering developments. Information available. ----------Item 246

ROOM AIR CONDITIONER. Page 131. This low cost cooling, heating, ventilating, filtering, dehumidifying and circulating unit is designed for individual rooms. Comes in 4 types, console, ceiling, concealed, and over-head models. Bulletin available. ----------Item 247

ELECTRIC MOTOR. Page 158. This fractional horsepower, variable speed motor gives you any RPM up to 10,000 in ratios up to 10:1. The unit is compact and dimensioned to occupy the least space. Bulletin available. ----------Item 248

YEAR-ROUND AIR CONDITIONING. Page 59. This company offers the world's finest heating and cooling products in a complete range of types and sizes. Equipment includes highboy air conditioners, wall radiation, baseboard heating, unit heaters, furnace air conditioners, and convector radiators. Bulletins available. ----------Item 249

REFRIGERATION. Page 170. This low velocity unit cooler for food processing and storage is designed especially to conserve space, maintain proper temperature, produce even air motion, and reduce shrinkage. Ideal for multiple unit installations. Information available.-------Item 250

ELECTRIC MOTORS. Page 152. This company has built 80 million motors in 25 years. These motors are small but powerful, compact and simple in design, and preferred by leading manufacturers. For highest performance specify these motors. Information available. ----------Item 251

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING
148 LAFAYETTE STREET
NEW YORK 13, N. Y.

AD-DIGEST SERVICE

WATER HEATERS. Page 47. These instantaneous heaters furnish industry with general service hot water, boiler feed water, and process water. They supply hotels, apartments, office buildings, dormitories, hospitals, and institutions. You get fast-action with these water heaters....Item 252

FANS AND COILS. Pages 34, 35. The efficiency features of these fans and coils can make a big difference in your built-up systems. They handle bigger jobs with more compact equipment and with greater reliability. Design features of this equipment not only gives you a more efficient coil but actually forms a stronger, more rigid unit than heretofore possible. Information available. .....Item 253

WATER HEATERS. Page 137. For rust-free hot water, look for the water heaters with the copper lining. The Waldorf-Astoria in New York depends upon these copper-lined water heaters for an unfailing supply of clean, hot water. These units outlast ordinary heaters. Catalog available. .....Item 254

LIQUID LEVEL CONTROL. Page 69. This positive liquid level control for amonia, Freon-12 and Freon-22 gives you peak performance on all flooded systems. This device is not affected by turbulence, tight closing is assured, there is no current flow through refrigerant, and only proven thermostatic expansion valve performance is employed. Bulletin available.....Item 255

DRAFT CONTROLS. Page 169. For commercial and industrial heating with gas, these draft controls are recommended by the nations leading gas companies. You can eliminate heavy fuel waste with complete safety. Information available. .....Item 256

TEMPERATURE CONTROL SYSTEMS. Page 31. In the modern 300 bed Moses H. Cone Memorial Hospital, correct temperatures and humidities for every need are effortlessly and accurately provided by an up-to-the-minute system of automatic temperature and humidity control. This system throughout the entire hospital, produces maximum comfort and faster recovery for patients, permits hospital personnel to concentrate on technical duties and insures the greatest return from every dollar spent for heating and cooling. .....Item 257

AIR CONDITIONING. Page 165. Fairchild Aircraft uses this company's air conditioning. The company recently completed the engineering and installation of a year-round comfort system for the aircraft company's new plant. Information available. .....Item 258

BOILERS. Page 57. This completely shop-assembled boiler is virtually on the line upon arrival, needing only hooking up of service connections before it goes to work. This widely used unit is suitable for a wide range of industrial, commercial, institutional and other installations. Information available. .....Item 259

VALVES. Page 60. Like their 1916 counterpart designs, this company's modern valves give performance that wins preference in every industry. They give values of steady leadership in steel casting, quality design, and precise manufacturing. Catalog available. .....Item 260

AIR CONDITIONING PUMPS. Page 145. These air conditioning pumps in a complete range of types and sizes are carried in stock by regional warehouses and authorized distributors throughout the country. The common sense approach to air conditioning pump specifications is to order these easily available units. Literature available. .....Item 261

FINNED COILS. Page 134. Extended surface heat exchangers featuring high efficiency, easy installation, and easy maintenance. List of users offered.....Item 262

AIR DIFFUSERS. Page 63. Floor to floor height can be kept to a minimum and usable floor space to a maximum with this company's high velocity air conditioning. These units, used with smaller than conventional ducts, save space, and money too. Manual available. .....Item 263

CONVECTOR RADIATION. Page 163. Superb styling and superb performance are what you get when you specify this company's convector radiation. These beautifully designed convectors have met every test for uniform, healthful heating. For long life and economical service, there is no finer convector built. Bulletin available. .....Item 264

COOLING TOWER. Page 162. This company's cooling tower has more capacity because the redistributing decks keep the water uniformly suspended, providing maximum contact between air and water. Casing and pump are of heavy gage steel, hot dip galvanized after fabrication. Unit is shipped assembled but can be knocked down to eliminate rigging costs, 3 to 8 ton capacities. .....Item 265

STEAM COILS. Page 170. A line of steam coils with defroster for use in combination with air conditioning coils or as tempering or booster units in long heating ducts. Information available.....Item 266

VENTILATION. Page 163. Where the problem is ventilation, the solution is this company's system. This company's rotary ventilators with or without fans can do the most for you. A 2 mph wind operates this company's rotary, and it continues to exhaust during wind lulls due to superior balance design. Information available. .....Item 267

VENTILATORS. Page 165. This company's ventilators are now available with blower or propeller. The units are easy to install, all aluminum, have a low silhouette, and their motor is sealed from the air stream. Catalog available. .....Item 268

AIR RECOVERY. Page 129. This air recovery system is a simple one by which used air can be reconditioned. It can be made completely odor-free and fresh for re-use. This sharply reduces the amount of outside air that has to be taken into a system and reduces the size of heating and cooling equipment required. Information available. .....Item 269

COOLING TOWERS. Page 41. Redwood trees live 1,000 years and this company uses all-heart redwood for the wetted deck surface of its propeller fan cooling towers are made from all-heart redwood fill to assure long life and trouble free operation. Bulletin available. .....Item 270

FINNED PIPE RADIATION. Page 73. A welded steel pipe that bristles with steel radiating fins. It has a big high-output heating surface, yet is compact. Mounted on the wall, it projects only between 3 to 5 inches into the room. Literature available. .....Item 271

REGISTERS. Page 28. Two lines of registers equipped with opposed blade damper—one for supply air, the other for return air. These dampers insure uniform distribution of air over the entire face of the register and provide positive damper setting in any position from fully opened to fully closed. Catalog available...Item 272

Use this Digest to locate and refer to advertisements appearing in this issue of HEATING AND VENTILATING, then fill out and mail the prepaid postcard to request further information.

AUTOMATIC FILTERS. Page 30. Where automatic filters are used, this company's self-cleaning type automatic filter is specified by a large retail chain. These filters adapt themselves to all types of air conditioning systems, are self-cleaning and easily supervised by laymen. Folder available. .....Item 273

COPPER PIPING. Page 71. A quiz on piping and piping materials, particularly as related to copper tubing. Can you answer these questions? A booklet on copper tube for industrial applications is available. .....Item 274

UNIT HEATERS. Page 53. A line of horizontal unit heaters in 19 sizes, gas fired unit heaters in 7 sizes, floor mounted unit heaters in 8 models, and heating and ventilating units assembled in many ways for all types of institutional and commercial installations. Catalogs available. .....Item 275

COPPER TUBE. Page 67. This copper tube is easy to bend and thus makes radiant heating jobs easy for you and better for your customers. Its soft temper for easy bending and light weight for easy handling are among its advantages. A system made of this tube is corrosion resistant and can never clog with rust.....Item 276

FANS. Page 15. From inlet to outlet this company's type BL fan gives more air per dollar. The inlet bell is smoothly curved, inlet vanes reduce turbulance, rotor features smoothness, quietness and efficiency, and fan performance is stable from shut off to free air delivery. Engineering bulletin available.....Item 277

EXPANSION COMPENSATOR. Page 149. A thermal expansion compensator for use in low-pressure steam and hot water heating systems is designed especially for finned type convectors, baseboard or radiators. Consists of two-ply bronze bellows with copper tube connections in sizes ¾ inch to 1¼ inch enclosed in a protective shroud of brass. A 2-inch size has standard threaded fittings. Will handle ⅛ inch of motion at temperatures from minus 60 F to 250 F and pressures to 40 psi. Bulletin available.....Item 278

HEAT EXCHANGERS. Page 65. Industrial fluid heaters of a variety of types including instantaneous water heaters, converters, tank heating units, storage tanks, fuel oil heaters and indirect heaters in a wide range of sizes for numerous uses in heating and ventilating work. Catalog available. .....Item 279

PLEASE SEND US MORE INFORMATION

Circle below item numbers on which you wish further information.

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215	216	217	218	219	220	221	222	223	224	225	226	227	228
229	230	231	232	233	234	235	236	237	238	239	240	241	242
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PLEASE PRINT Nov. AD-54

This service available only to U. S. and Canadian readers

Name..... **Title**.....

Firm .....

Nature of Firm's Business.....

Street .....

City..... **Zone**..... **State**.....

This card is void after Feb. 1, 1955

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

Ad-Digest SERVICE

UTILITY VENTILATING SETS. Page 161. These fans are available in a belt drive and a direct drive and are furnished ready to install to duct work and electrical connections. Accessories available include hood covers, automatic shutters mounted in fan discharge and outlet control damper. Catalog available....Item 280

COPPER WATER TUBE. Page 125. An endorsement of panel heating with copper water tube is given by a heating contractor who has been in the business for 20 years and in the radiant heating field for 9 years. He prefers this company's tube because it is easy to bend and handle, comes in long lengths which require fewer fittings and it cannot rust so that the contractor is kept out of trouble. Information available. .....Item 281

PIPE INSULATION. Page 37. An unusual pipe insulation which installs itself in that it is poured on underground pipe, tamped and backfilled, and the job is insulated. The heat in the pipe fuses the insulation to the pipe resulting in an underground pipe insulation at low cost. Available in three grades. Literature available. .....Item 282

POWDER FASTENERS. Page 160. These powder operated fasteners are as much as four times faster than old fashioned conventional methods of drilling and setting studs for such purposes as fastening pipe and duct hangers to masonry. Specification manual available. .....Item 283

AIR DRYING. Page 168. Controlled humidity air conditioning by this method which removes moisture from air by contact with a liquid in a small spray chamber. The spray contact temperature and the absorbent concentration factors easily and positively controlled, determine exactly amount of moisture remaining in leaving air. Information available.....Item 284

EVAPORATOR PRESSURE REGULATOR. Page 45. They keep your coolers from bursting and prevent freeze-up with this company's evaporator pressure regulators which hold evaporator pressures up to predetermined point when the load changes. Available for any size water cooler from drinking fountains to large industrial installations. .....Item 285

AIR FILTERS. Page 159. These high velocity air filters have specially hemmed edges for strength and safe, easy handling. Features include maximum efficiency, minimum resistance, no direct air passage and large dust holding capacity. Catalogs available. .....Item 286

MOTORS. Page 163. Thousands of unit heaters, electric hoists, hydraulic pumps, exhaust fans, oil burners, and other equipment receive dependable power from this line of motors which is available in sizes from 1/20 to 5 hp. Bulletin available. .....Item 287

WALL IUSULATION. Page 5. This multiple accordian aluminum insulation envelops large volumes of air and creates layers of air spaces only as it is opened and when finally stapled in place. This air is really free. Condensation formation on or within is minimized by the scientific construction. Booklet available....Item 288

CONTACT PYROMETER. Page 157. Check temperature of steam traps, motors, and bearings, quickly and accurately with this portable contact pyrometer for taking surface temperatures. This instrument can be your most useful maintenance and installation tool. Bulletin available. .....Item 289

ELECTRONIC CONTROLS. Page 24. These electronic controls provide the most advanced control systems known today. Hitherto, unknown flexibility in control of temperature and humidity can be yours with this company's extensive developments in electronic circuits. Included in this company's line are ultra-sensitive relay, electronic hot water controls, electronic temperature controls, and electronic humidity controls. Literature available. .....Item 290

WROUGHT IRON PIPE. Page 7. This ad presents the higher cost of wrought iron pipe as an investment which will forestall premature repairs due to corrosion and results in actually a saving in the long run. It states further that the only valid comparison of piping costs is installed cost plus repairs. Information available. .....Item 291

STEAM TRAPS. Page 21. This ad states that more than a million of this company's impulse steam traps have now been sold. These traps feature quick heating, even temperatures, low maintenance, small size, and light weight. Information available. .....Item 292

AIR CONDITIONERS. Page 74. This company's air conditioners plus cooling coils, heating and ventilating units, supply and exhaust fan were installed to furnish clean, fresh air for St. Luke's Church in Oklahoma City. The system cools 20,000 square feet of floor space including, auditorium, sanctuary, study rooms, game rooms, kitchens, and hallways. Information available. .....Item 293

TEMPERATURE CONTROL. Pages 16, 17. Some of Minnesota's best modern schools are equipped with this company's modern systems of pneumatic temperature control. These control systems assure utmost classroom comfort at maximum fuel economy. Many users report 25 to 40 years of reliable, low maintenance cost service. Information available. .....Item 294

AIR ELIMINATOR. Page 20. This company's new air eliminator provides a simple, inexpensive, but highly efficient means of collecting and automatically removing air from radiant coils, baseboards or convectors. Air in water moves with circulation and is trapped and released by the eliminator, thus preventing air from interfering with circulation. This operation is accomplished by breaking the flow of water which causes air to separate from the water. Information available. .....Item 295

ELECTRIC MOTORS. Page 40. This company's capacitor-start induction motors are the right kind of motors to use for most single-phase applications. They have become first choice of many leading manufacturers of air conditioners, refrigerators, freezers, water pumps, and motor-driven tools, and are used in many other similar fractional or integral horsepower applications. Information available. .....Item 296

FANS. Page 146. When planning your ventilating systems get all the facts. Each new job presents different cooling and ventilating problems that this company can successfully solve for you. Write for complete data on the hundreds of possibilities offered in the wide range of styles, sizes and capacities. Data sheets available. .....Item 297

HEAVY OIL BURNERS. Page 150. These oil burners use commercial No. 4 or No. 5 heavy oils and are especially designed for heating buildings requiring more than 6,000 gallons of oil or 45 tons of coal per year. Conversion is simple. Bulletin available. .....Item 298

POWDER POWER TOOL. Page 151. A fast acting system of drive pins and explosive cartridge action for fastening duct work to steel or concrete features an exclusive break-open action of the holding tool and a single standard powder charge regardless of penetration desired. Cannot be discharged accidentally. Air conditioning ducts installed in a Miami hotel in record time with this tool. Literature available. .....Item 299

FABRICATION SERVICE. Page 171. By eliminating numerous flanged joints and combining several fittings into one integral unit, this company's fabrications assure greater efficiency and real economy from the simplest to the most complex layout. Bulletin available.....Item 300

COOLING TOWERS. Page 127. A 20-year guarantee on the wetted-deck surface of these residential cooling towers is offered by the manufacturer. These towers recirculate precious water, meet requirements of municipalities which prohibit wasting cooling water to sewers and are low in cost. Bulletin available....Item 301

DAMPER EQUIPMENT. Page 70. This ad features the company's damper set for multi-blade dampers which provides perfect damper control in heating, ventilating and air conditioning blower exhaust systems, their silent duct, a flexible connection, and their vane runners for making turning vanes in square elbows. Information available. .....Item 302

UNIT HEATERS. Inside front cover. You get heat where you want it, when you want it, whatever the fuel you use with this company's unit heaters. This company's name is backed by over 60 years of heating experience. Regardless of the type of model you choose, you can depend on this company's unit heater to give balanced heating performance plus maximum fuel economy. Information available. .....Item 303

FIRE PROTECTION EQUIPMENT. Page 161. This company's line of interior fire protection equipment includes 480 cabinets alone. This equipment is proved reliable, economical, easy to install and generally best for clients. Information available. .....Item 304

Postage Will be paid by Addressee

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BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 58, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

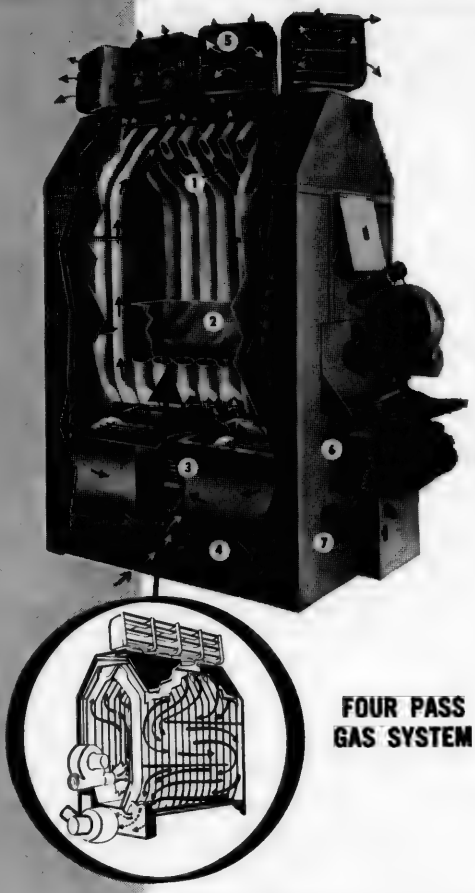
HEATING AND VENTILATING

148 LAFAYETTE STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

heat transfer surface



FOUR PASS GAS SYSTEM

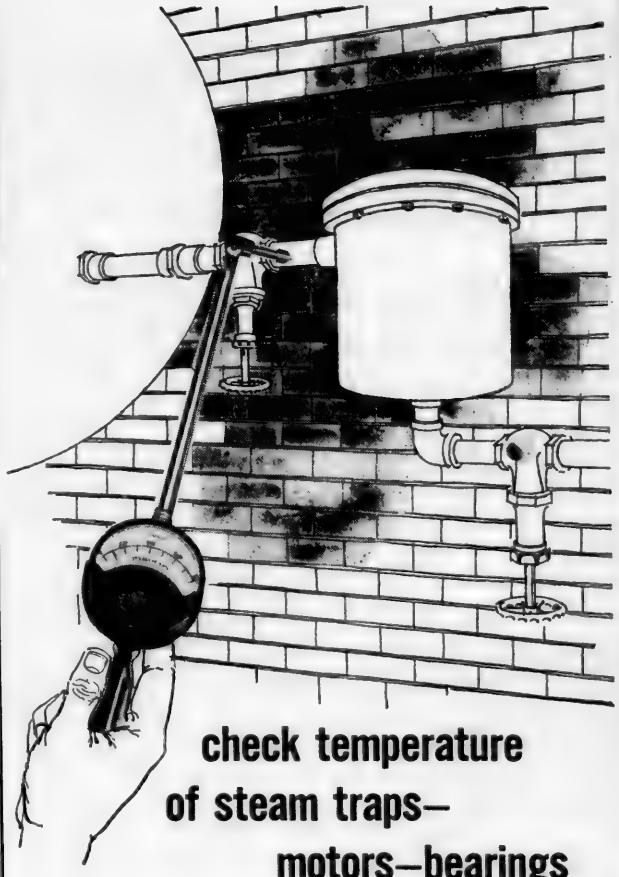
Induced flame and gases of combustion make four complete passes on the left and right sides of the Olson heat transfer surface over the air to be heated. Here's a heat transfer surface, even more effective than the highest recommendations of accepted heating authorities. It provides long life and maximum efficiency through the exclusive Olson feature of a bank of standard 10 guage, 4" O.D. boiler tubes. The hot air is distributed through directional 360 louvered bonnets or duct connections.

Olson

ARTHUR A. OLSON & CO.
CANFIELD, OHIO

Representatives in principal cities

HEATERS FOR GAS, OIL, COAL, OR DUAL GAS AND OIL



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 514, 420 N. LaSalle St., Chicago 10, Ill.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

GIVES YOU ANY RPM—
AND ONLY 14¼" HIGH!

FRACTIONAL
HORSEPOWER
VARIABLE SPEEDS
—IN SMALLEST PACKAGE

4 TO
10,000
RPM
IN RATIOS UP TO 10:1

14¼" HIGH x
8½" WIDE
WEIGHT—87 LB.
EASIEST
DIAL CONTROL
SINGLE AND
3-PHASE

U.S. MOTORS

Here's the lightweight U.S. Varidrive, Type VA, compactly dimensioned to occupy least space, yet suitable for rugged industrial duty just like the larger HP Varidrive line. Compact dimensions and light weight now make built-in application of variable speeds practical.

QUICK, ACCURATE DIAL CONTROL

Full speed range instantly obtained in less than one turn of dial handle. The stationary dial plate is precisely calibrated for close setting, yet easily visible from a distance.

GETS YOU MORE PRODUCTION

You can greatly increase the performance and output of your machine using fractional horsepower with Type VA. Your operator can control the speed to a split rpm to accomplish better workmanship and to gain more output.

U. S. ELECTRICAL MOTORS INC.
Los Angeles 54, Calif. Milford, Conn.

U.S. VARIDRIVE MOTORS

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Box 2058, Los Angeles 54, Calif.
or Milford, Conn.
NAME_____
COMPANY_____
ADDRESS_____
CITY ZONE STATE

EXPOSITION EXHIBITS

(*Continued from page* 152)

ments. Exhibitors in all categories have kept pace with engineering advances, and while many new units have been introduced since the last exposition two years ago, many more await disclosure in January.

● **BROADENED LINES.**—A number of exhibitors whose lines are rapidly expanding have taken more space at the exposition than ever before. One such will exhibit boilers, convectors and cooling systems as components of steam and hot water heating installations; also air moving equipment, thermostat controls, industrial boilers, and warm air heating units. Another will display oil-and-gas-fired furnaces, cast iron and steel boilers, gas conversion burners, oil conversion burners, oil and gas recessed wall heaters, room and central air conditioners. A third, showing for the first time its new line of suspended oil or gas furnaces will also display steel oil-fired forced warm-air furnaces in low-boy and counterflow models, several models of oil or gas low-boy gravity heaters, and also a line of burners.

● **AIR CONDITIONING.**—Air conditioning equipment on view at the exposition will include complete systems of all types, many of the exhibitors having a strong leaning toward packaged units. There will also be a wide range of components and associated equipment such as ducts, registers, diffusers, convectors, radiators, and all manner of regulating devices and systems. In all of these, new features will be introduced, many of a radical nature.

● **CONTROLS.**—Among exhibits of control equipment will be one of the well-known lines, including manual and magnetic motor starters for both across-the-line and reduced voltage starting; also a line of pilot devices, including pressure switches, temperature switches, float switches, control relays and push buttons. Another exhibit in the same field will include a new magnetic starter, specifically designed for air conditioning equipment. It was completed and put into production only during the past year. Associated with this display is a line of heating and ventilating switches for both surface and flush installation.

● **AIR-MOVING EQUIPMENT.**—There will be numerous displays of air-moving equipment in complete ranges of capacity and for all classes of service. One new line of centrifugal fans, heading into production at the beginning of the new year, has backward-curved blades, resulting in lower revolutions and higher efficiencies. A manufacturer of roof ventilating units, as well as general purpose fans and blowers, will also be in production with a new line before the show opens.

● **CONNECTIVE EQUIPMENT.**—Many items of new design will be shown in the way of connective equipment, specifically, ducts, piping and tools for the work of field installation. One exhibit will show snap-lock pipe in five-foot lengths, well suited for perimeter and small pipe systems, especially in crawl-space installations, because of its ready assembling and hanging features. The same exhibitor has a line of stainless steel chimney liners for gas heat installations, especially conversion jobs. Another line of

(*Continued on page* 160)

Airsan Viro Crimp
HIGH VELOCITY AIR FILTERS

VIRO CRIMP MEDIA
has special Hemmed Edges for strength and safe, easy handling. No cuts! No Scratches! No Filter surface damage.

- MAXIMUM EFFICIENCY (288 — 510 FPM)
- MINIMUM RESISTANCE
- NO DIRECT AIR PASSAGE
- LARGE DUST HOLDING CAPACITY

Also Available . . .
Low Velocity and Grease Filters.
Write for catalogs and prices.

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1084 NORTH WATER ST. • MILWAUKEE, WIS.
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A few distributorships available.
Write for details!

Solve your Problems in

Sizes 1¼" to 36" I.D.

AIR CONDITIONING
FUME CONTROL AND VENTILATION
DUST AND CHIP COLLECTION
MATERIALS HANDLING

with **FLEXAUST®**
HOSE
The high-quality, reinforced, spiral-wire hose designed for moving air, dust, fumes, materials.

Here Are Cost-Cutting Advantages:

- **EASY INSTALLATION** — Unskilled labor can cut, couple or cuff Flexaust hose in a jiffy. It's so light, a child can lift it.
- **DURABLE, STRONG** — Flexaust hose is highly resistant to abrasives, aging, corrosion, moisture, chemical deterioration and flexing fatigue. It has a bonded, double ply, double overlap construction.
- **AIRTIGHT**—Ideal for pressure, suction, or gravity operations.
- **HIGHLY FLEXIBLE** — Can maintain large sections on sharp bends; won't kink or flatten.

WRITE TODAY for new bulletins on FLEXAUST hose and companion PORTOVENT® duct: Product Information • Accessories and Installation • Technical Data • Application Data.

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Dept. HV-11, 100 Park Avenue, New York 17, New York
Distributors in Principal Cities

FLEXAUST® PORTOVENT® BLOFLEX® ®Trademark

KODY
AXIAL FLOW

THE PROBLEM

- Trapping and removal of injurious fumes, vapors, odors, dust and heat.

THE ANSWER

KODY BISECTED FANS

Direct connected . . . yet completely isolated in an inner housing the motor, coupling and bearing are bypassed by injurious gases.

Kody Bisected Fans can be mounted in any position.

WRITE FOR CATALOG OF OUR COMPLETE LINE...
A-1K

KODY BLOWER COMPANY
TRENTON, NEW JERSEY

Saves 75% of fastening time by anchoring sheet steel wall with fast, easy *Ramset* system

About 20,000 individual fastenings were needed to anchor 4′ x 8′ 12-gauge perforated steel sheets to steel beams, to wall the paint hangar at the recently completed airplane plant of North American Aviation Corporation, Columbus, Ohio. The wall is required to permit adequate ventilation of 47,250 square feet of space, with a change of air every three minutes from air intakes and exhausts located on opposite sides.

Using RAMSET JOBMASTER fastening tools and Tru-Set drive pins, fastenings were made at a rate better than 50 per hour per man, or 1,200 per day for a three-man crew. This was at least 4 times faster than old-fashioned, conventional methods of drilling and setting studs in the beams. Not only was the work completed far sooner, but a substantial cost-reduction was realized.

Similarly, RAMSET SYSTEM saves money and time on almost any job of fastening to steel or concrete for maintenance, modernization or new construction. Anchoring can be done in split seconds into the hardest concrete, or into mild steel up to 1″ thick, with the proper selection of tools, fasteners and power charges from the versatile RAMSET line.

Ask your RAMSET dealer how you can profitably apply RAMSET SYSTEM to your own work, or write us for details and *Specification Manual*.

Ramset Fasteners, INC. RAMSET DIVISION, OLIN INDUSTRIES, INC.

12135 BEREA ROAD • CLEVELAND 11, OHIO

FIRST IN POWDER ACTUATED FASTENING — AN Olin PRODUCT

EXPOSITION EXHIBITS

(*Continued from page* 158)

prefabricated duct fittings for 4½-inch pipe also includes registers designed for the small-pipe systems, as well as baseboard diffusers in 2-, 4-, and 8-foot sections.

● **SPECIALTIES.**—The list of specialities to be seen at the show is quite varied, including draft controls, automatic gas shut-off valves useable even with corrosive type gases; a line of humidifiers that will fit all types of forced-air furnaces, counterflow, hi-boy, floor, horizontal-suspended, and the conventional plenum designs.

Canadian Degree Days for September, 1954

City	September		Cumulative	
	1954	Normal	1954	Normal
Calgary, Alta.	472	432	472	432
Charlottetown, P.E.I.	270	222	270	222
Crescent Valley, B. C.	342	360	342	360
Edmonton, Alta.	420	444	420	444
Fort William, Ont.	427	354	427	354
Grande Prairie, Alta.	480	480	480	480
Halifax, N. S.	196	189	196	189
London, Ont.	179	126	179	126
Medicine Hat, Alta.	335	267	335	267
Moncton, N. B.	315	282	315	282
Montreal, P. Q.	248	180	248	180
North Bay, Ont.	387	264	387	264
Ottawa, Ont.	283	204	283	204
Penticton, B. C.	244	213	244	213
Porquis Junction, Ont.	501	396	501	396
Prince George, B. C.	456	444	456	444
Quebec City, P. Q.	336	276	336	276
Regina, Sask.	414	408	414	408
St. John, N. B.	318	270	318	270
Saskatoon, Sask.	426	396	426	396
Toronto, Ont.	150	168	150	168
Vancouver, B. C.	222	234	222	234
Victoria, B. C.	278	264	278	264
Windsor, Ont.	80	54	80	54
Winnipeg, Man.	371	330	371	330

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

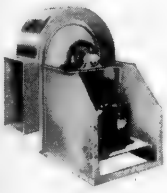
ASA CONFERENCE—Fifth national conference on Standards and 36th annual meeting of the American Standards Association, at the Roosevelt Hotel, New York, N. Y. Secretary of the Association, 70 East 45th St., New York 17, N. Y. . . . . **NOVEMBER 15-17, 1954.**

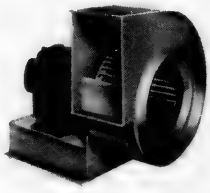
REFRIGERATION SERVICE ENGINEERS CONVENTION—17th Annual convention of the Refrigeration Service Engineers Society, at the Raddison Hotel, Minneapolis, Minn. Secretary of the Society, 2577 No. Teutonia Ave., Milwaukee 6, Wis. . . . . **NOVEMBER 18-21, 1954.**

(*Concluded on page* 162)

UTILITY TYPE VENTILATING SETS

The MASSACHUSETTS Line®





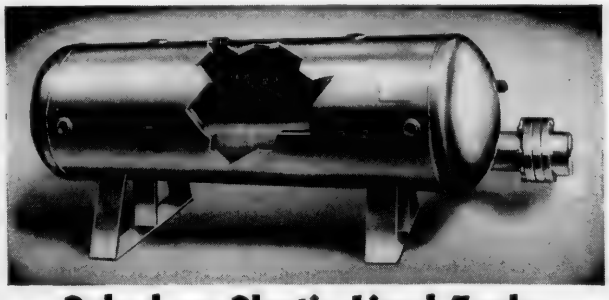
PROBLEMS ARE SOLVED when "The MASSACHUSETTS Line" enters the picture.

Bulletin No. 109 Catalog contains certified ratings authorized by NAFM as applied to type MSV belt drive and type S direct drive sets.
These economical package type units are furnished ready to install to duct work and electrical connections. Accessories available include hood covers, automatic shutters mounted in fan discharge and outlet control damper. The new MSV size 30 design 3 has a rugged squirrel cage type wheel and is rapidly gaining popularity.

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

4901 HAMILTON AVENUE • CLEVELAND 14, OHIO



Baked on Plastic Lined Tanks
last longer—cost less

NOVELON baked on plastic lined carbon steel tanks can often replace more costly installations of steel alloys and non-ferrous metals.

FIVE BASIC ADVANTAGES (1) Low initial cost, (2) Heat resistance up to 500° F., (3) Smooth, non-porous surface which can be readily cleaned, (4) Imparts no color, odor, or taste to contents, (5) Will not deteriorate with age.

Guaranteed for 10 Years.

Novelon offers a wide selection of other linings such as cement, rubber, lead and copper, to meet the many corrosion problems of industry.

If you are planning to install new tanks or to replace old worn out tanks, contact us now. Our complete fabricating and lining facilities will save you money and add years of usefulness to your tanks.

For free literature and information write or phone . . .

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Quality Fabricators for 50 Years

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PROVED RELIABLE, ECONOMICAL

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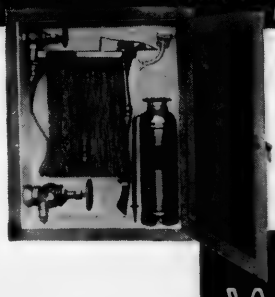
INTERIOR FIRE-PROTECTION EQUIPMENT

Complete Line—480 Cabinets Alone
Modern, Most Widely Used



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Reliable Delivery—
Goes in Easier

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W. D. ALLEN Manufacturing Co.

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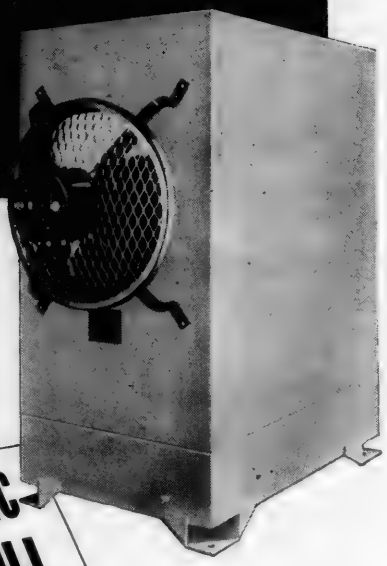
COOLING TOWER

by

KRAMER



3 to 8 Ton

SCIENTIFIC NEW FILL

MORE CAPACITY

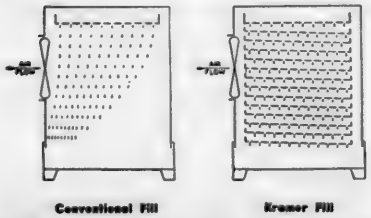
The redistributing decks keep the water uniformly suspended, providing maximum contact between air and water.

LONG LIFE

Casing and sump are heavy gauge steel, hot dipped galvanized after fabrication. Redistributing decks are metal and fireproof.

EASY INSTALLATION

Unit is shipped assembled but can be knocked down to eliminate rigging costs. One fitting required for drain and over-flow.



Conventional Fill — Kramer Fill

Write for Catalog R-225

KRAMER TRENTON CO.
Trenton 5, N.J.

(*Concluded from page* 160)

ASME MEETING—Annual meeting of the American Society of Mechanical Engineers, at the Statler Hotel, New York City. Secretary of the Society, 29 W. 39th St., New York City. . . . . **NOVEMBER 28-DECEMBER 3, 1954.**

ASRE CONVENTION—50th Annual convention of the American Society of Refrigerating Engineers at the Benjamin Franklin Hotel, Philadelphia, Pa. M. C. Turpin, secretary of the Society, 234 Fifth Ave., New York City, N. Y. . . . . **NOVEMBER 28-DECEMBER 1, 1954**

POWER SHOW—21st National Exposition of Power and Mechanical Engineering, at the Comercial Museum, Philadelphia, Pa., to be held under the auspices of The American Society of Mechanical Engineers. E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. . . . . **DECEMBER 2-7, 1954.**

CHEMICAL ENGINEERS MEETING—Annual meeting of the American Institute of Chemical Engineers, at the Statler Hotel, New York, N. Y. Secretary of the Institute, 29 W. 39th St., New York, N. Y. . . . . **DECEMBER 12-15, 1954.**

NATIONAL RETAIL INDUSTRY SHOW—First National Retail Industry Show of the Store Modernization Institute, combined with the 5th Store Modernization Show at Madison Square Garden, New York, N. Y. John W. H. Evans, secretary of the Institute and managing director of the Show, 20 E. 55th St., New York, N. Y. . . . . **JANUARY 7-11, 1955.**

SOLAR ENERGY SYMPOSIUM—A world symposium on applied solar energy, sponsored by Stanford Research Institute, Stanford, Calif. at the Westward Ho Hotel, Phoenix, Ariz. Chairman of the Institute, 612 S. Flower St., Room 332, Los Angeles 14, Calif. . . . . **JANUARY 12-15, 1955.**

ASHVE MEETING—61st annual meeting of the American Society of Heating and Ventilating Engineers, at the Benjamin Franklin and Bellevue-Stratford Hotels, Philadelphia, Pa. A. V. Hutchinson, executive secretary of the Society, 62 Worth St., New York 13, N. Y. . . . . **JANUARY 24-27, 1955.**

HEATING & VENTILATING EXPOSITION—12th International Heating & Ventilating Exposition, at the Commercial Museum and Convention Hall, Philadelphia, Pa., held under the auspices of the American Society of Heating and Ventilating Engineers. E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. . . . . **JANUARY 24-28, 1955.**

TESTING MATERIALS MEETING—1955 spring meeting of the American Society for Testing Materials, at the Netherland-Plaza Hotel, Cincinnati, Ohio. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. . . . . **JANUARY 31-FEBRUARY 4, 1955.**

INDUSTRIAL VENTILATION CONFERENCE—The 14th Annual Conference for bringing together plant engineers, contractors and others interested in industrial ventilation, is co-sponsored by Michigan Department of Health, Division of Occupational Health, and Michigan State College, School of Engineering. Held at Kellogg Center, Michigan State College, East Lansing, Michigan. James C. Barrett, Ventilation Engineer, Division of Occupational Health, Michigan Department of Health, Lansing 4, Michigan. . . . **FEBRUARY 14-17, 1955.**

CORROSION ENGINEERS CONVENTION—Annual convention of the National Association of Corrosion Engineers, at the Palmer House, Chicago, Ill. A. B. Campbell, executive secretary of the Association, 1061 N&M Building, Houston 2, Tex. . . . . **MARCH 7-11, 1955.**

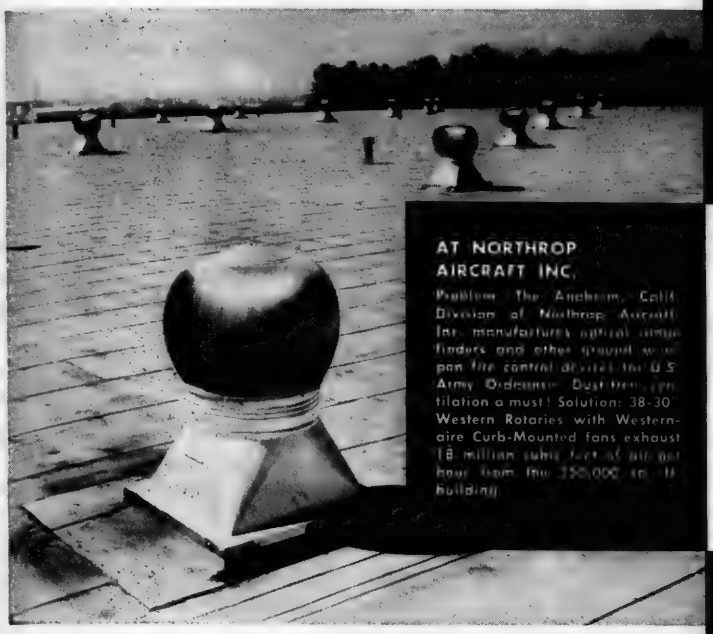
OIL HEAT CONVENTION—33rd annual convention of the Oil-Heat Institute of America, tentatively set for the Conrad Hilton Hotel, Chicago, Ill. R. H. L. Becker, secretary of the Institute, 500 Fifth Ave., New York 36, N. Y. . . . . **APRIL 19-21, 1955.**

LUBRICATION ENGINEERS MEETING—Annual meeting and exhibit of the American Society of Lubrication Engineers, at the Hotel Sherman, Chicago, Ill. Wm. P. Youngclaus, Jr., secretary of the Society, 84 E. Randolph St., Chicago 1, Ill. . . . . **APRIL 13-15, 1955.**

MECHANICAL ENGINEERS MEETING—Spring meeting of the American Society of Mechanical Engineers, at Lord Baltimore Hotel, Baltimore, Md. C. E. Davies, secretary of the Society, 29 W. 39th St., New York, N. Y. . . . . **APRIL 18-20, 1955.**

INTERNATIONAL CONGRESS OF REFRIGERATION—Ninth International Congress of Refrigeration, sponsored by the International Institute of Refrigeration, to be held in the conference rooms of the Sorbonne in Paris, France. General Secretariat of the Congress, International Institute of Refrigeration, 177, Boulevard Malesherbes, Paris, France . . . . . **AUGUST 31-SEPTEMBER 15, 1955.**

Where the problem is ventilation — the solution is a WESTERN SYSTEM



AT NORTHROP AIRCRAFT INC.

Problem: The Anaheim, Calif. Division of Northrop Aircraft Inc. manufactures optical sighting finders and other ground work on fire control devices for U.S. Army Ordnance. Dust-free ventilation a must! Solution: 38-30" Western Rotaries with Western-aire Curb-Mounted fans exhaust 18 million cubic feet of air per hour from the 250,000 sq. ft. building.

AT YOUR PLANT

Western Rotary ventilators, with or without fans, can do the most for you. A 2 mph wind operates the Western Rotary—and it continues to exhaust during wind lulls due to superior balance design. Years of trouble-free performance—bearings carry lifetime guarantee. Check Sweet's or AEC for high exhaust capacity figures. Then specify Western—a first-rate line of rotary, stationary, continuous ridge, directional ventilators and exhaust fans. Handled by wholesalers coast to coast.

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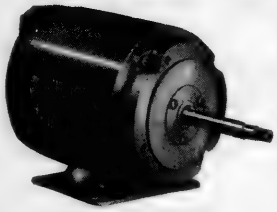
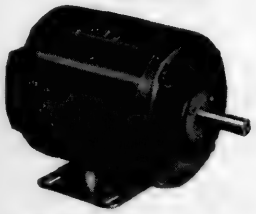
Dealers—order from your local jobber. Write for catalog, or tell us your special installation problems.

Do it with a DOERR MOTOR!



When we say that Doerr Motors are made for tough industrial applications, we can back it up 100%. The entire range of machine tools—from power tools up to boring mills—utilize Doerr Motors for a large variety of main and auxiliary drives. Many thousands of small electric hoists, hydraulic pumps, unit heaters, exhaust fans, rotary oil burners and adjustable speed drives receive dependable power from Doerr.

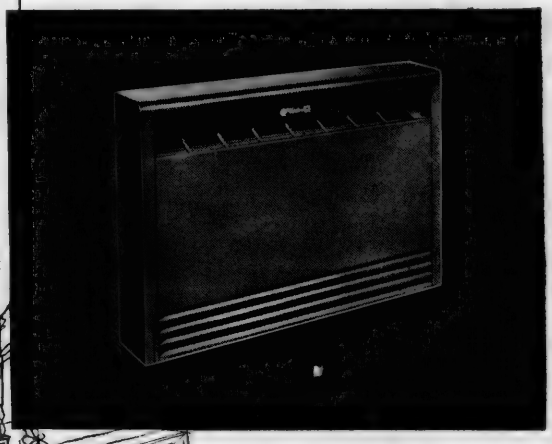


If you want more information, write for Bulletin 100, which shows many of the special and standard designs available.

Electric Motors from 1/30 to 5 hp. Standard, or designed to your specification.

DOERR
Electric Corporation
CEDARBURG, WISCONSIN

modern heating at its best



Modine convector radiation

SUPERB styling . . . superb performance. You get both when you specify Modine convector radiation. These beautifully designed convectors have met every test for uniform, healthful heating . . . for long-life, economical service. There is no finer convector built.

Ask the Modine representative listed in your classified phone book for all the facts. Or write for Bulletin SA-54, Modine Mfg. Co., 1511 DeKoven Ave., Racine, Wis.

A magnetic sleeve, rising and falling within a non-magnetic tube, "trips" or releases an Alnico permanent magnet attached to a mercury switch. Basically, this is Magnetrol.

With boilers you're either SAFE OR YOU'RE NOT! There's no in between. Provide the assured safety of Magnetrol for only pennies more!

Magnetrol uses only infallible magnetic force to provide completely positive boiler water level control.

Inherently and by design this is the safest system known! . . . and the *only* one that insures all these benefits:

INFINITE OPERATING LIFE—there are no bellows, diaphragms, electrodes or packing boxes to fail.

LEAST SERVICING entailing call-backs or operating interruptions. The lifetime quality built into Magnetrol extends to every part.

EASIEST, SIMPLEST MAINTENANCE—normally confined to visual inspection and blow-down.

EASIEST TO ADJUST IN THE FIELD—this means simpler installation and certainty of proper functioning.

Magnetrol units are available in single or multi-stage models for all control applications. Standard boiler units for pressures of 25 to 600 lbs. WSP.

THE FULL STORY IS SO IMPORTANT IT BELONGS IN YOUR HANDS. MAIL COUPON NOW.

MAGNETROL, Inc.

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Gentlemen: Please send me Catalog Section III and full information on Magnetrol Boiler Water Level Controls.

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ABSTRACTS AND REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

STEAM, AIR, AND GAS POWER

Just published is the fifth edition of Steam, Air and Gas Power by William H. Severns, professor of mechanical engineering, University of Illinois; Howard E. Degler, technical director, Marley Company; John C. Miles, professor of mechanical engineering, University of Illinois.

Fundamental material of earlier editions have been revised to make it more useful for study and reference, and to keep up with the change brought on through the intervening years, a large amount of new material has been added.

The fifth edition has expanded material on gas turbines. There is a new chapter on mechanical refrigeration. The scope of the section on air compressors has been broadened to include centrifugal and axial-flow types. Specific heat information has been added in the thermodynamics chapter. Material on fuels and combustion has been augmented by sections on the combustion of oils and gases. In general, the book follows the arrangement of earlier editions. There are two introductory chapters to explain the terminology of heat power.

The book is intended to be used as a text for basic courses in heat power, theory, practice and equipment.

Steam, Air and Gas Power, by W. H. Severns, H. E. Degler and J. C. Miles. Cloth bound, 5½ x 8¼ inches. 502 pages. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price, $6.50.

PROCEEDINGS OF NDHA—1952

Papers, committee reports and discussions presented as part of the National District Heating Association convention held at Skytop Lodge, Skytop, Pa., June 3 to 6, 1952, are now available as the Official Proceedings of the Forty-third Annual Meeting of the National District Heating Association.

What makes these proceedings particularly valuable is that they contain not only the papers and the various committee reports but also the discussions that followed these presentations.

Proceedings of the National District Heating Association—1952. Cloth bound, 6 x 9 inches, 231 pages. Published by the National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. Price, $10.

TIME-SAVER STANDARDS

To all who design, remodel or build buildings, there should be helpful information in Time-saver Standards, a manual of essential architectural data. The first edition of this book, compiled by the editors of Architectural Record was published in 1946, the second in 1950, and now the third edition is available.

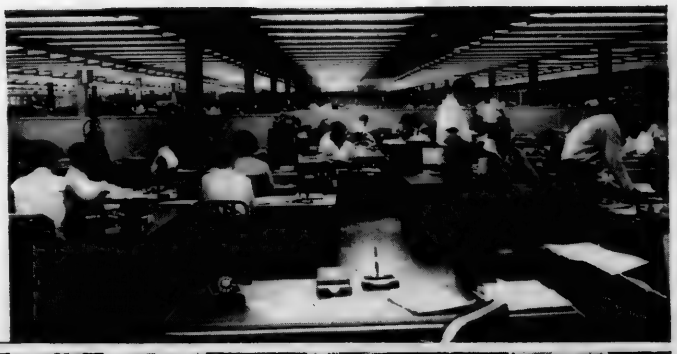
As compared to the previous edition, more than 100

(*Concluded on page* 166)

FAIRCHILD AIRCRAFT USES

FRICK

Air Conditioning



Frick Company recently completed the engineering and installation of a year 'round comfort air conditioning system for the new office annex of the Fairchild Aircraft plant in Hagerstown, Md., where they manufacture their famous C-119 Flying Boxcars.

The cooling load of 245 tons of refrigeration is carried by two Frick "ECLIPSE" 9-cylinder high-speed compressors.

For the latest in air conditioning and refrigeration engineering and equipment, look to Frick Company, now in its second century of service to business and industry.

DEPENDABLE REFRIGERATION SINCE 1852

FRICK CO.

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One of the new Fairchild offices and pair of Frick "ECLIPSE" compressors which provide comfort cooling.

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FOR COLD MORNINGS, HARD-TO-HEAT PLACES

CHROMALOX Electric UNIT HEATERS

EASY TO INSTALL WHEREVER TEMPORARY OR PERMANENT COMFORT HEAT IS NEEDED

CHROMALOX Unit Heaters quickly and economically give needed warmth wherever heat is required. Air is forced across CHROMALOX Finstrip elements by a quiet fan and directed into the desired areas by adjustable louvers. High velocity discharge assures adequate supply of heated air. Units are available with manual or automatic controls in 1.5 to 15 KW. capacities.

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COOK VENTILATORS

now with BLOWER or PROPELLER

Easy to install • All aluminum • Low silhouette
Motor sealed from air stream

Each blade is balanced, set and locked in proper pitch by taper-pin bolt.

Blower type, Model BV from 9" to 21". Backwardly inclined impeller, non-overloading.

Propeller type, Model FV from 12" to 24". Thousands of Cook-built propellers are in daily use.

7", 9" or 10" Blower Roof Ventilator Model R

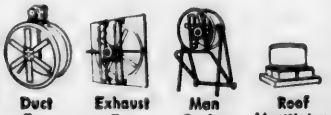
All models direct drive . . . damper optional

Model R with square base

Model R with slope base

Model R with round base

COOK



Duct Fan | Exhaust Fan | Man Cooler | Roof Ventilator

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"THREE OF A KIND"
. . . from a total of 16 sizes

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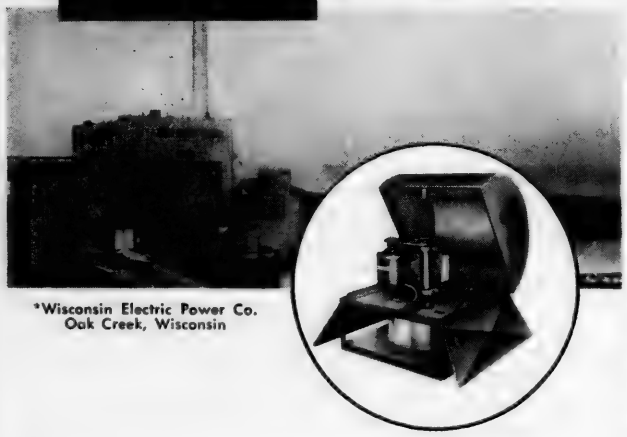
DYNAFANS

keep air on the move at new $100 million power plant!*



*Wisconsin Electric Power Co.
Oak Creek, Wisconsin

From *powerhouse* to *powder room* . . . from *aircraft* to *zoological* buildings . . . Penn ventilator applications literally range from A to Z!

The Penn Ventilator Sales Engineer in your area has complete data on all the types of powered and gravity roof ventilators in Penn's complete line. You would do well to call him on your next ventilation problem.

Complete Literature Available Write to Engineering Department

PENN VENTILATOR COMPANY

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In Eastern Canada: Air-Caire, Ltd.
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Member of the Power Fan Manufacturers Association

FOR MORE THAN 25 YEARS THE BUILDERS' ROOF TOP LINE

(*Concluded from page* 164)

pages have been added, and pages have been regrouped to make the contents more usable to its readers.

The material in this book has been arranged in six major sections as follows: Office practice—drafting standards, symbols and fundamental data; structural design and construction methods; design elements—residential; design elements—non residential; recreation, site planning and landscaping; building materials and equipment. The information presented consists not only of graphic details but both design principles and their applications.

Time-saver Methods, by the Editors of Architectural Record. Cloth bound, 8½ x 11 inches, 888 pages. Published by F. W. Dodge Corp., 119 W. 40th St., New York, N. Y. Price, $12.50.

• • •

WEEKLY WEATHER AND CROP BULLETIN—The Weather Bureau of the U. S. Department of Commerce is publishing, in its "Weekly Weather and Crop Bulletin, National Summary," current degree day figures for 200 cities. This table appears once each month. The degree days are given for the preceding month and the cumulative degree days for that city since July 1. This is a 4-page weekly publication available through the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at $3 per year for U. S. readers, $4 for readers outside of the U. S.

DEAERATORS AND DEAERATING HEATERS—The third edition of Standards and Typical Specifications for Deaerators and Deaerating Heaters has been issued to help purchasers of such equipment. Tables of shell and head thicknesses have been revised and expanded. Diagrams have been added to show typical arrangements of deaerating units. Heat Exchange Institute, 122 E. 42nd St., New York 17, N. Y. Price, $1.

GASES FROM CRUDE SHALE OIL—The question of the use of shale oil in the production of high-Btu oil gases has been investigated by the Institute of Gas Technology, Chicago. This study was sponsored by the American Gas Association under its Promotion-Advertising-Research Plan. Results are published in the booklet Production of High-Btu Oil Gases from Crude Shale Oils. Institute of Gas Technology, 17 W. 34th St., Technology Center, Chicago 16, Ill. Price, $2.50.

CANADIAN WEATHER DATA—The Climatological Atlas of Canada is a 255-page book containing a mass of exceedingly interesting and valuable maps of Canada on which are plotted temperature, sunshine, humidity, wind, and rainfall data. Most of these are of value to heating and air conditioning engineers either living in or doing design work in the Dominion. It was prepared under the direction of Morley K. Thomas. The book, which sells for $2, is a joint publication of the Division of Building Research, National Research Council, and The Meteorological Division, Department of Transport, Canada. It is obtainable from the Accounts Section, National Research Council, Ottawa, Ontario, Canada.

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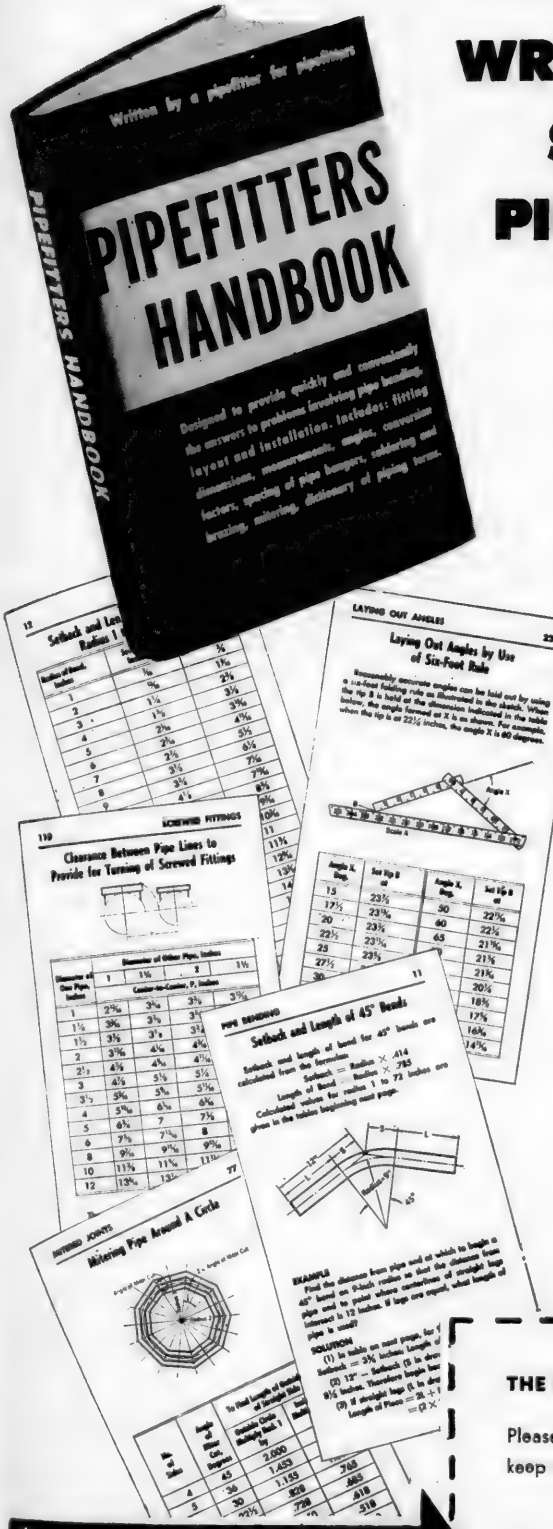
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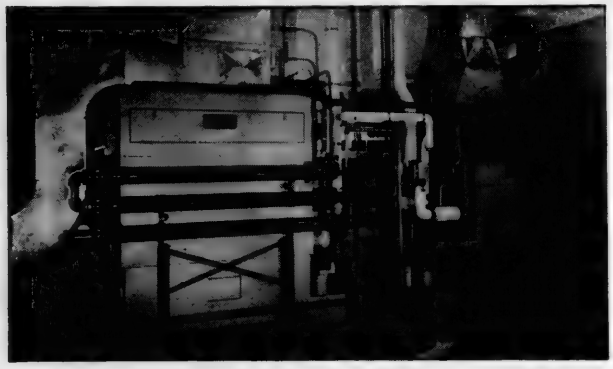

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(*Concluded from page* 111)

lies for 24 hours at the bottom of the primary air chamber, so that much of the coke pushed out with it becomes burnt before the next operation of the ram pushes it into a collecting box.

Break-drafts are regularly used to even out chimney pulls and prevent them from being excessive. When burning coke, a break-draft may be necessary to *increase* the chimney pull. Zeno probably didn't think of this one.

If combustion is efficient, excess air a minimum, and burning rate very low, the flue gases will be a mixture of nitrogen and carbon dioxide mainly, and significantly heavier than air at the same temperature. When these gases have given up their heat to any water or air heat-exchangers and to the brickwork it is possible for the chimney to become filled with a column of gas actually heavier than the air outside. The fire goes on burning, because inside the fuel bed the temperature is quite high enough to counteract any density effect. But the gases do not go up the chimney. They find their way somehow out into the boiler room or kitchen. If combustion is not quite complete there may be CO in such gases.

Putting in a break-draft dilutes the chimney gases, making them lighter, and the greater volume does not cool down to quite the same temperature. Warm air from the room helps to maintain a positive draft up the chimney. All this could have been predicted theoretically, but in Holland it was thought desirable to prove it by actual demonstration. In the Instituut voor Warmte-Economie at Delft various types of coke-burning appliances were operated at lower and lower ratings until chimney back-pressures were observed. E. H. van de Beek records the results in the Instituut's Report No. 27.

It is a point of honor to leave the reader of any article on solid fuel in a state of confusion, so it should now be recorded that when one buys coke of a certain nominal size there is a lot of undersize with it; samples 3 and 4 in the photo both came out of the same bunker in your Correspondent's backyard. Despite this, Dr. Parker, Director of Fuel Research, speaking to the British Association for the Advancement of Science, was able to say that smoke production from heating appliances has been much reduced in recent years as a result of increased use of coke. And at the same session Mr. Dick of the Building Research Station said that with an *internal* flue an open fire could be 40% efficient.

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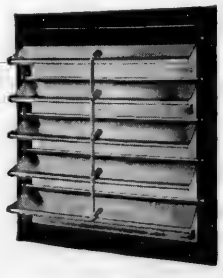

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(*Concluded from page* 138)

cept for a short time on each shift. The peak demand will generally occur when employees are going off shift and will last from 15 to 30 minutes. The fixtures will be used practically continuously during this period and it is therefore desirable to store sufficient hot water to meet the requirements of this period and to provide heating surface to heat the contents of the tank from 40 to 140F in a period of about two hours.

TABLE 3—DEMAND FACTOR FOR SCATTERED AREAS

Number of groups of fixtures	2	3	4	5 or more
Factor	0.8	0.7	0.6	0.5

The hot water requirements for the cafeteria, if there is one in the plant, should be considered separately as health authorities usually require that water for this service shall be available at 180F.

The water demand in gallons for the various commonly used plumbing fixtures which require hot water, is given for a peak period of twenty minutes in Table 4.

The hot water line from the top of the hot water tank is so piped that there will be no long dead end runs supplying groups of fixtures; at the highest point it feeds up to a frequently used fixture which permits the escape of air from the system.

TABLE 4—PEAK HOT WATER DEMAND

Fixture	Peak Demand, Gallons (20 min period)
Private lavatory	3
Public lavatory	15
54-inch dia wash fountain	60
Shower—5-inch rainhead	60

Note: Percentage of the total demand to be stored is 90%, and two hours is the time to be allowed for heating the total demand.

The last fixture on the supply line is one that is frequently used which creates a flow in the system. After passing the last fixture, the pipe size is reduced and continued back to the return connection on the underside of the tank. A check valve is provided in this line to prevent reversal of flow when drawing water at any of the fixtures near the end of the line. The loop provides means for a continual gravity circulation of hot water through the system and consequently hot water is available at all of the fixtures almost immediately after the faucet is turned on.

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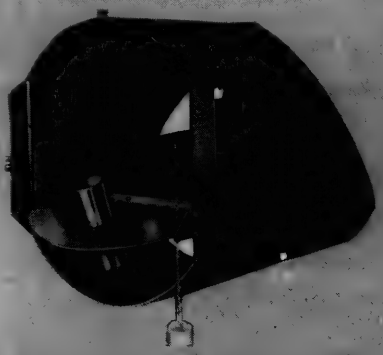

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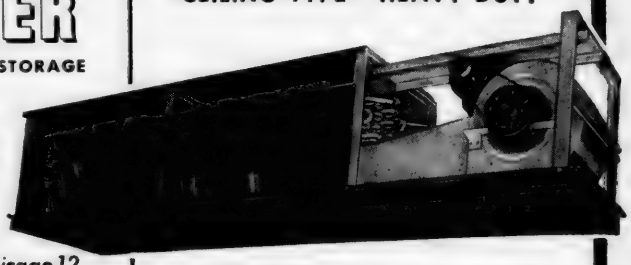

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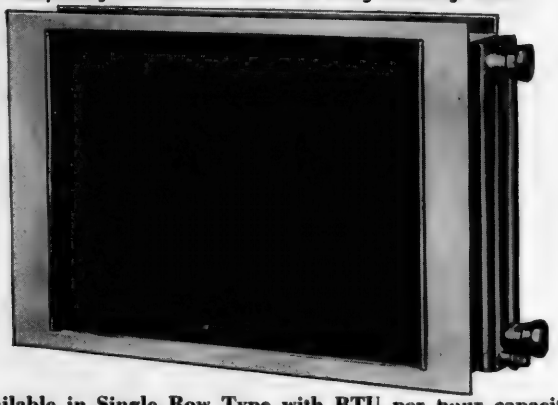

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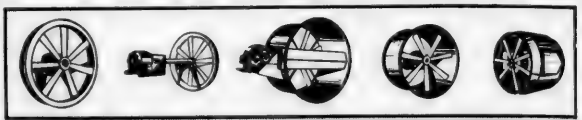

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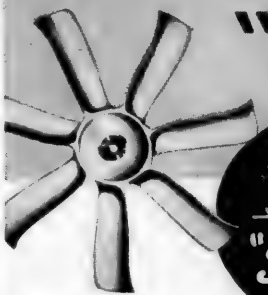

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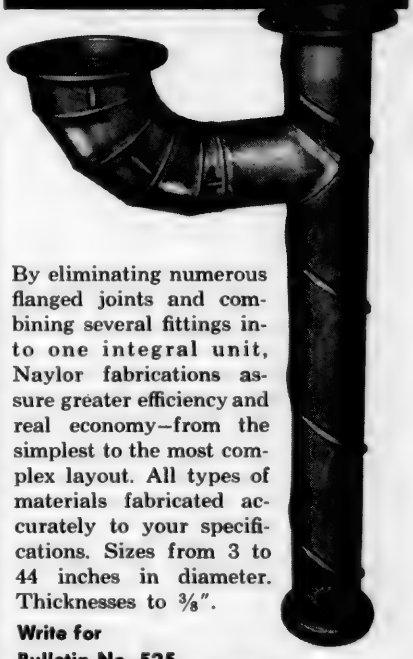

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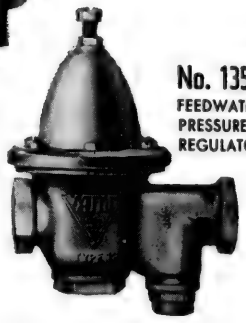

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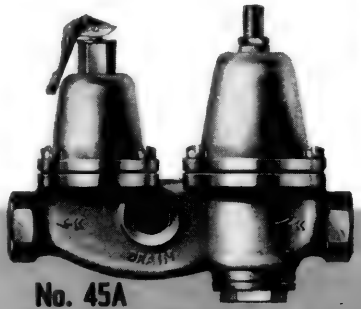

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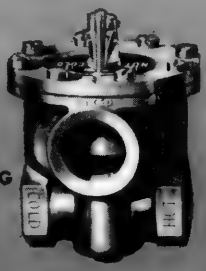

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THE ROOF AS A LOCATION FOR AIR CONDITIONING EQUIPMENT

The accompanying discussion of the advantages and disadvantages of roofs and basements as locations for air conditioning equipment was prepared by Edwin Sternberg, of Fred L. Moesel Associates, New York, N. Y.

At one time, the invariable practice of designers was to locate the refrigeration system for the air conditioning installation in a basement or sub-basement machine room, irrespective of refrigeration capacity required. With basement installations, foundations for the main pieces of equipment such as refrigeration compressor and driving motor or turbine, chilled water and condenser water circulating pumps could rest on bedrock underlying the building foundations. This was a logical location then, due, in part, to the available equipment which was bulky, heavy in weight and noisy. In the case of slow speed reciprocating compressors, vibration and pounding had to be counteracted. In addition, operation of the equipment was generally manually controlled. Therefore, a basement machine room was convenient for the full attention of the operating engineer.

The development of automatic, compact refrigeration equipment and the evaporative condenser for water conservation, have changed this situation with the result that today the equipment can be located anywhere in the building, providing adequate means of isolation are installed. Basement machine rooms are not a must in the overall design of a system; economic and space considerations should be determining factors in the final selection of the machinery location.

Both roof and basement locations for the necessary equipment have distinct advantages as well as disadvantages. The capacity in tons of refrigeration for the proposed plant is an important consideration in arriving at a satisfactory decision.

Advantages of Roof

Use of Evaporative Condensers. When the refrigeration compressors are located within a machine room on the top floor of a building or a penthouse designed for this purpose, evaporative condensers can be located within a very short distance of the compressors. Since such condensers can be located on the compressor room roof above or alongside of the penthouse, usually there is no problem of air supply and discharge for the equipment. This arrangement eliminates the need for water-cooled condensers, cooling tower and circulating pump and also reduces the cost of refrigerant piping. The compressor brake horsepower per ton of refrigeration can be kept to a minimum by the installation of adequate size evaporative condensers, thereby reducing the actual cost of operation.

The physical size of the evaporative condenser is usually smaller than that of an equivalent capacity cooling tower. Maintenance of the evaporative condenser depends on its construction; a well designed condenser should have upkeep similar to a cooling tower. Water treatment for both types is desirable, especially in contaminated air surroundings, to protect condensing coils and condenser tubes. Prime surface condensing coils with corrosion-protected metal such as hot-dip galvanizing or non-ferrous tubes and corrosion-resistant fans are very desirable.

Evaporative condensers can be enclosed in a louvered shell similar to cooling towers to improve their appearance.

Multiple Units. It is economically feasible to divide the total required refrigeration capacity between several compressors. The evaporative condenser installation can likewise be made with separate coils or a separate unit for each refrigeration compressor. This arrangement provides flexibility in the operation of the plant under varying load requirements and can readily be accomplished with the roof installation due to the close spacing of all equipment.

Automatic Control. The development of automatically operated refrigeration equipment lends itself to the roof installation. Refrigeration compressors and evaporative condensers can be readily controlled automatically by a means such as the chilled water temperature. This arrangement provides maximum economy of operation in matching the required load and does not require continual supervision by the operating engineer. Periodic supervision by the operating engineer to check machine operation, oiling and pressures, can readily be combined with other duties. A bell or light in the operating engineer's office connected to the high pressure cut-out and to the low temperature chilled water thermostatic cut-out, will give added protection to the system in case of faulty operation.

Size of System. The total capacity of the refrigeration system is a paramount factor in the determination of location. Small and medium tonnage installations that lend themselves to the use of reciprocating compressors, either singly or in multiple, have greater economic advantages when located in roof machinery rooms than do large tonnage installations which generally require centrifugal or axial-flow compressors. The latter are built with integral water-cooled condensers and therefore require a cooling tower. The high weight concentration of the cooling tower over a small area calls for heavier structural framing and supports. Usually this is not the case with the smaller capacity, lighter weight reciprocating compressors. It would be impossible to set up an arbitrary tonnage figure as a boundary between reciprocating and centrifugal compressors, for each installation should be analyzed from a cost standpoint and decided on its own merits.

Ventilation. Adequate ventilation of machinery rooms is often a problem to the designer. It is obvious that the roof installation can be readily ventilated at a minimum cost due to its close proximity to outside air. Ductwork required for the

basement location can be eliminated and it is not difficult to locate the fresh air intake and exhaust louvers. In some roof installations, the evaporative condenser can be set at one end of the machinery room with the outside air intake louvers placed at the opposite end. The condenser fans will then augment the machinery room ventilation by drawing air across the compressor area.

Location of Air Conditioning Equipment. The location of the air conditioning equipment can plan an important part in arriving at the best location for the refrigeration equipment. When the air conditioning equipment is located in the upper floor or penthouse fan rooms of a building, it is obvious that a most economical installation can be made should the refrigeration equipment be located nearby. With the development of primary air conditioning systems used in conjunction with individual room conditioners, a pent-house or top floor fan room has decided advantages, and lends itself to such an arrangement. There are other less obvious advantages such as the lower static water pressure on the chilled water circulating pump casing which exists when the pump is located at the top of the closed circulating system. This arrangement minimizes stuffing-box seal maintenance problems.

Machinery Space. The location of equipment presents an economic problem, especially in rental type buildings. For example, in large cities where the building cost per cubic foot is high, the basement area, which is usually reserved for refrigeration equipment, can yield a good return when rented for restaurant or similar use. This basement use for a restaurant is feasible if good air conditioning and ventilation are provided and arrangements made for a ground floor entrance. In some cases, the elimination of costly rock excavation required for a subbasement equipment room can materially change the construction cost. With the increasing use of district steam, the basic need for high ceiling boiler rooms is eliminated and this tends to further reduce excavation cost. The exclusion of a high ceiling refrigeration equipment room can again help reduce these costs. It must be remembered that the refrigeration capacity of the installation, as discussed previously, plays an important part in the analysis.

Disadvantages of Roof

Supporting Structure. The roof installation obviously requires both a supporting structure for the dead weight of the equipment and adequate bracing for unbalanced loads. The additional steel requirements in the form of columns, girders and beams is a function of several variables so no arbitrary standards can be established. For example, the installation of multiple smaller capacity refrigeration compressors and evaporative condensers does not present the same structural problem that would be encountered with one or two large capacity units. In the former case, by judicious location of the equipment with reference to the main load supporting columns and beams, the cost of additional framing can be minimized; in the latter case, the supporting structure must be designed to meet the expected loadings which may result in deep section girders and beams.

This situation can increase the floor to floor heights to maintain proper headroom under the structural supports. The building height directly affects the cost of additional steel for columns. A skyscraper type of building, with multiple setbacks and with high refrigeration requirement, obviously is not as well suited to a roof installation as a building of lower height and with uniform floor areas. The designer should analyze each type of structure on its own merits. In many cases, the floor loading selected by the structural engineer for fan rooms is suited to the loading imposed by small tonnage refrigeration equipment without additional steel framing.

Vibration. Reciprocating compressors located on a building roof present problems of vibration isolation to prevent transmission and telegraphing of this motion to the occupied portions of the building. Small multicylinder compressors do not create the same situations as large compressors of slower speed. Several types of vibration-absorbing bases and foundation are available, each engineered to the particular type of installation. Specialists in vibration-control should be consulted.

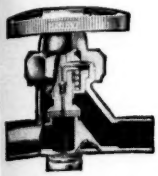
It is not costly to isolate a small compressor and the same type of isolation would generally be used irrespective of the equipment location. Large units require spring-supported floating structural subbases which in turn must be properly supported by the building. In some cases, weight must be incorporated in the base to absorb unbalanced forces.

It is desirable to isolate interconnecting piping from the building structure by the use of isolated pipe hangers and flexible seamless tube type connections at the equipment.

Services to Equipment. Electric power must be carried from the main service location, usually located in the basement, to the equipment on the roof. The cost of this service will depend on the distance involved and the wire size. When the fan room is located nearby, both power requirements can be combined; this is less costly than where a separate service is run to each. Separate metering and switches can be located in a service center.

Since the water supply must be brought to the evaporative condenser or cooling tower, irrespective of where the design places the refrigeration equipment, no new situation is established. Water can be taken from the main water supply for the water-cooled stuffing-box seals, make-up water for the chilled water system, and for similar needs.

Installation of Equipment. The cost of rigging refrigeration equipment to a roof location will usually be greater than for a basement location. Rigging costs should be estimated for each location and this figure used in the cost analysis.



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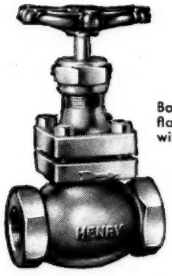

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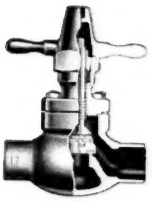

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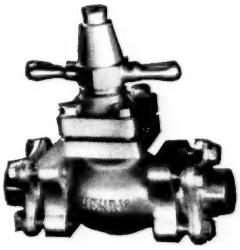

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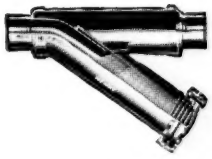

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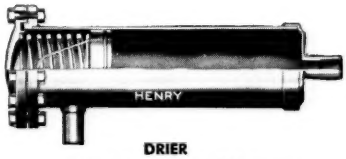

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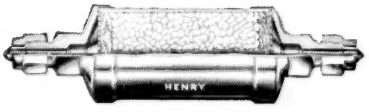

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